DOCUMENT RESUME

ED 368 095 EC 302 840

AUTHOR	Saccuzzo, Dennis P.; And Others
TITLE	Identifying Underrepresented Disadvantaged Gifted and Talented Children: A Multifaceted Approach. (Volumes 1 and 2.)
INSTITUTION	San Diego State Univ., Calif.
SPONS AGENCY	Department of Education, Washington, DC.
PUB DATE	94
CONTRACT	R206A00569
NOTE	147p.; For individual chapters, see EC 302 841-846.
PUB TYPE	Reports - Research/Technical (143) -- Information Analyses (070)
EDRS PRICE	MF01/PC06 Plus Postage.
DESCRIPTORS	*Ability Identification; Aptitude Tests; Cultural Differences; Culture Fair Tests; *Disadvantaged Youth; Educational Diagnosis; Elementary Secondary Education; Ethnic Groups; *Gifted; *Intelligence Tests; Low Income Groups; Minority Group Children; *Screening Tests; Test Bias
IDENTIFIERS	*Raven Progressive Matrices; *San Diego Unified School District CA

ABSTRACT

The primary purpose of this study was to determine if a model for identifying gifted and talented students could be developed which would provide equal access to gifted programs for children of all ethnic and economic backgrounds. The culturally and ethnically diverse San Diego City School District provided a pool of over 35,000 children referred for giftedness whose records were coded and analyzed through this research. Based on these findings, a model designed to increase the proportion of ethnically and economically diverse students referred for assessment and identified as gifted was implemented and evaluated, with the Raven Progressive Matrices used as the criterion measure of intellectual ability. Component research papers by Dennis P. Saccuzzo, Nancy E. Johnson and Tracey L. Guertin cover the following topics: the use of the Raven Matrices in an ethnically diverse gifted population; use of the Wechsler Intelligence Scale for Children - Revised (WISC-R) with disadvantaged gifted children; evaluation of risk factors in selecting children for gifted programs; information processing in gifted versus nongifted African-American, Latino, Filipino, and White children; ethnic and gender differences in locus of control in at risk gifted and nongifted children; and understanding gifted underachievers in an ethnically diverse population. Appendices include a teacher nomination form, a student/parent information form, and an independent evaluation review, in which author Margie Kitano finds the new model to have significantly impacted school system practice and increased the number and proportion of underrepresented students referred and identified although failing to fully meet the initial criterion for equal access. (Contains 222 references.) (Author/PB)

U.S. DEPARTMENT OF EDUCATION
Office of Educational Research and Improvement
EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)

☑ This document has been reproduced as received from the person or organization originating it.

☐ Minor changes have been made to improve reproduction quality.

• Points of view or opinions stated in this document do not necessarily represent official OERI position or policy.

ED 368 095

IDENTIFYING UNDERREPRESENTED DISADVANTAGED GIFTED AND TALENTED CHILDREN: A MULTIFACETED APPROACH

(Volumes 1 and 2)

Dennis P. Saccuzzo, Nancy E. Johnson, & Tracey L. Guertin

San Diego State University

EC 302 840

BEST COPY AVAILABLE

IDENTIFYING UNDERREPRESENTED DISADVANTAGED GIFTED AND TALENTED CHILDREN: A MULTIFACETED APPROACH

(Volume 1 & 2 Set)

Dennis P. Saccuzzo, Nancy E. Johnson, & Tracey L. Guertin

San Diego State University

This research was funded by Grant R206A00569, U.S. Department of Education, Jacob Javits Gifted and Talented Discretionary Grant Program.

The authors express their appreciation to the San Diego Unified City Schools, to Gifted and Talented Education (GATE) Administrator David P. Hermanson, and to the following school psychologists: Will Boggess, Marcia Dijiosia, Eva Jarosz, Dimaris Michalek, Lorraine Rouse, Ben Sy, and Daniel Williams.

Correspondence should be addressed to Dennis P. Saccuzzo, Joint San Diego State/ University of California, San Diego Doctoral Training Program, 6363 Alvarado Court, Suite 103, San Diego, California 92120-4913 (Telephone: 619-594-2844 / FAX: 619-594-6780 / e-mail: dsaccuzz@sunstroke.sdsu.edu).

© 1994
Do not reproduce in any form without express written permission from the authors.

PREFACE

The present two volume set represents some of the major findings of a three year Jacob Javits grant (#R206A00569) funded by the U. S. Department of Education entitled: Identifying Underrepresented Disadvantaged Gifted and Talented Children: A Multifaceted Approach. Volume 1 presents an overview of the project and includes an invited article for *Gifted Child Quarterly* by Margie Katino of San Diego State University (see Appendix III to Volume 1). Professor Kitano's article provides an independent evaluation of the results of the grant.

Volume 2 is divided into 6 chapters. These chapters provide the technical basis for the conclusions reached in Volume 1 and describe in detail the secondary aspects of the grant.

This two volume set represents our best efforts to summarize and disseminate our findings within the severe time constraints of the termination of our funding as of 12/31/93. While the information provided is of considerable relevance to the attainment of equal access to gifted and talented programs, it is important to emphasis that we have far more data than it was possible to present in analyzed form by the deadlines under which we operated. We plan to continue to refine the various manuscripts that comprise Volume 2 and to add additional manuscripts to augment and support the findings presented herein.

The authors are indebted to numerous individuals. We would like to thank our technical monitor, Norma Lindsay, for her strong support. We are also indebted to the San Diego Unified School System, to gifted and talented program administrator, David Hermanson, and to the School Psychologists who administered the thousands of tests that provided the basis for our analyses. We would also like to thank the more than 30 special studies students who enrolled for independent study under Professors Johnson and Saccuzzo. These excellent students aided in the data collection and data input, and in return received invaluable hands-on-experience in dealing with real-world research problems. We would also like to thank Arlysse Kienle for her role in typing several versions of the various manuscripts, and to Susan McLaughlin for her role in the data collection and study of locus of control. Helen Veinbergs and Chris Bernet also played a significant role in the early stages of the data collection process. In addition, numerous San Diego State and University of California, San Diego students participated in professional conventions by presenting preliminary findings based on data collected for this grant.

Nancy E. Johnson's predoctoral studies were funded, in part, by funds from this grant. Her doctoral dissertation is included in its entirety in Volume 2. In addition, this grant funded a year of full time postdoctoral study for Dr. Johnson. Dr. Johnson participated in all phases of this work and conducted the lion's share of the data analyses.

Although many people played a critical role in this project, the authors are solely responsible for its contents. We welcome comments and criticisms, and will do our best to incorporate feedback into any final published manuscript. We can only hope that in some small way the present findings contribute to our understanding of identifying traditionally underrepresented gifted children and achieving equal access in selecting children from all walks of life for gifted programs.

Dennis P. Saccuzzo
Nancy E. Johnson
Tracey L. Guertin

12/17/93

TABLE OF CONTENTS

Volume 1		1
Appendix I	*Teacher Nomination Form*	16
Appendix II	*Student/Parent Information Form*	18
Appendix III	*In Search of an Equal Access Model: Review of Saccuzzo's "Identifying Underrepresented Disadvantaged GATE Children" by Margie K. Kitano*	19
Volume 2		27
Chapter 1	*Use of the Raven Progressive Matrices Test in an Ethnically Diverse Gifted Population*	29
Chapter 2	*Use of the WISC-R with Disadvantaged Gifted Children: Current Practice, Limitations, and Ethical Concerns*	43
Chapter 3	*Evaluation of Risk Factors in Selecting Children for Gifted Programs*	79
	Part 1 *Gifted Children at Risk: Evidence of an Association between Low Test Scores and Risk Factors*	81
	Part 2 *Intelligence, Aptitude, and Achievement in Gifted Children With and Without Language Risk*	93
Chapter 4	*Information-Processing in Gifted versus Nongifted African-American, Latino, Filipino, and White Children: Speeded versus Nonspeeded Paradigms*	103
Chapter 5	*Ethnic and Gender Differences in Locus of Control in At Risk Gifted and Nongifted Children*	119
Chapter 6	*Understanding Gifted Underachievers in an Ethnically Diverse Population*	127
References		135

IDENTIFYING UNDERREPRESENTED DISADVANTAGED GIFTED AND TALENTED CHILDREN: A MULTIFACETED APPROACH

(Volume 1)

Dennis P. Saccuzzo, Nancy E. Johnson, & Tracey L. Guertin

San Diego State University

This research was funded by Grant R206A00569, U.S. Department of Education, Jacob Javits Gifted and Talented Discretionary Grant Program.

The authors express their appreciation to the San Diego Unified City Schools, to Gifted and Talented Education (GATE) Administrator David P. Hermanson, and to the following school psychologists: Will Boggess, Marcia Dijiosia, Eva Jarosz, Dimaris Michalek, Lorraine Rouse, Ben Sy, and Daniel Williams.

Correspondence should be addressed to Dennis P. Saccuzzo, Joint San Diego State/University of California, San Diego Doctoral Training Program, 6363 Alvarado Court, Suite 103, San Diego, California 92120-4913 (Telephone: 619-594-2844 / FAX: 619-594-6780 / e-mail: dsaccuzz@sunstroke.sdsu.edu).

© 1994
Do not reproduce in any form without express written permission from the authors.

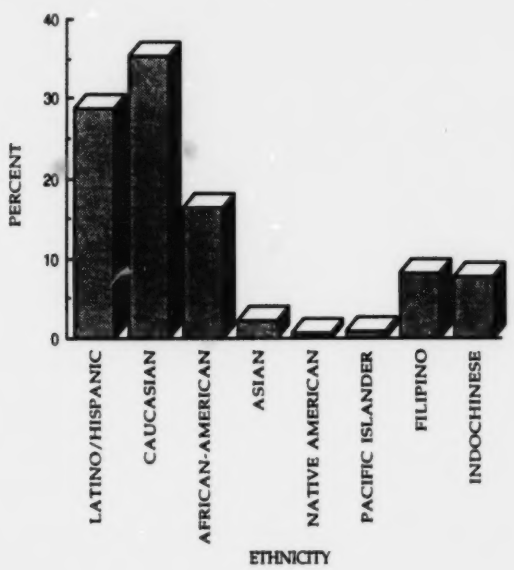
IDENTIFYING UNDERREPRESENTED DISADVANTAGED GIFTED AND TALENTED CHILDREN: A MULTIFACETED APPROACH

Grant #R206A00569, U.S. Department of Education, Jacob Javits Gifted and Talented Discretionary Grant Program

Students from diverse social, cultural, linguistic, and economic backgrounds are consistently under identified for Gifted and Talented Education (GATE) programs in every major city in the nation. More specifically, there are systematic discrepancies between the percentages of ethnic minority students in GATE programs and their percentages in their respective school districts. The problem of the under identification of ethnic minorities in GATE programs is broad and persistent. As Richert (1985, 1987) and Colleagues (Richert, Alvino, & McDonnel, 1982) have repeatedly noted, figures reported by the U.S. Department of Education's Office of Civil Rights reveal that groups such as African-American and Latino/Hispanic are under represented by as much as 70% in gifted programs throughout the nation. A study in California found discrepancies between the percentage of ethnic minorities in GATE programs and the percentages in their respective school districts in each of the 193 school districts that were evaluated over a three year period (Sunset Review Advisory Committee III Report, 1986).

Equal access means that children from diverse ethnic and economic groups are evaluated and selected for GATE programs in proportion to their numbers in the district as a whole. The primary purpose of "Identifying Underrepresented Disadvantaged Gifted and Talented Children: A Multifaceted Approach", a grant supported by the Jacob Javits Gifted and Talented Discretionary Grant Program of the U.S. Department of Education, was to determine if a model of selection could be developed that would provide equal access to gifted programs for children of all ethnic and economic backgrounds. The San Diego City School District, which is among the most diverse in the country, provided an excellent site for determining if the lofty goal of equal access could be achieved on a large scale basis. The district has over 123,000 children, with approximately 29% Latino/Hispanic, 38% Caucasian, 16% African-American, and the remainder in significant numbers across five additional ethnic backgrounds (see Figure 1).

Figure 1. 1992/1993 district ethnic composition: San Diego Unified School District



There were a number of limiting factors in the present effort to develop an equal access model of selection. First and foremost, **IT WAS NECESSARY TO APPLY A CONSISTENT APPROACH TO SELECTION ACROSS ALL ETHNIC BACKGROUNDS**. The present project was not simply to determine if more underrepresented children could be identified for GATE programs, given some special or new procedure applied specifically to that group. It was an attempt to determine if a single standard could be applied to the entire population and produce an equal access result. Special ethnic norms could not be used, and were unacceptable to all elements of the community. If something special was being done for one group, it had to be applied to all.

A second limiting factor was that **THE METHODS OF IDENTIFICATION WOULD BE OBJECTIVE AND RELIABLE**. This limitation ruled out subjective rating systems and other approaches whose results could not be rigorously repeated.

The third limiting factor was that **THE SELECTION PROCESS WOULD HAVE TO BE PRACTICAL AND COST EFFECTIVE.** Given a school system of over 123,000 children, as many as 5–10,000 children had to be evaluated yearly. A procedure was needed that could successfully accomplish this evaluation process without the need for a small army of trained professionals, which was not available.

A fourth limiting factor was that the gifted program was an **ACADEMIC PROGRAM**, based on high intellectual ability or high achievement. There were no programs available for other types of giftedness, such as exceptional artistic or musical ability.

The final limiting factor was that **THE PRESENT STUDY WAS INITIATED WITHIN A SCHOOL DISTRICT THAT ALREADY HAD A LARGE, THRIVING GIFTED PROGRAM DATING BACK TO THE 1950'S, WITH AN ESTABLISHED SYSTEM OF IDENTIFICATION ALREADY IN PLACE AND AN ADMINISTRATIVE UNIT TO IMPLEMENT THIS SYSTEM.**

Within these limitations, the present study provided one of the most extensive, if not the most extensive, study of the efficacy of standard psychometric tests in providing a uniform standard of identification for giftedness across ethnic background. When the proposal was first funded in October of 1990, the traditional identification procedures used by the school system, which relied heavily on standardized group and individual achievement and intelligence tests, was well underway. The two primary measures in use were the Developing Cognitive Abilities Test (DCAT), a group test of verbal, quantitative, and spatial aptitude, and the Wechsler Intelligence Scale for Children-Revised (WISC-R), the most widely used individual test of intelligence for children. The process of implementing the present project thus began with an evaluation of these two tests and the identification procedures that were in use. At the same time, the efficacy of the Raven Progressive Matrices Test, a culturally reduced measure of general intelligence, was evaluated. Prior to reporting on the results of these evaluations, the model that was ultimately recommended, and the many practical problems that were encountered, it is important to note the secondary goals of the present project.

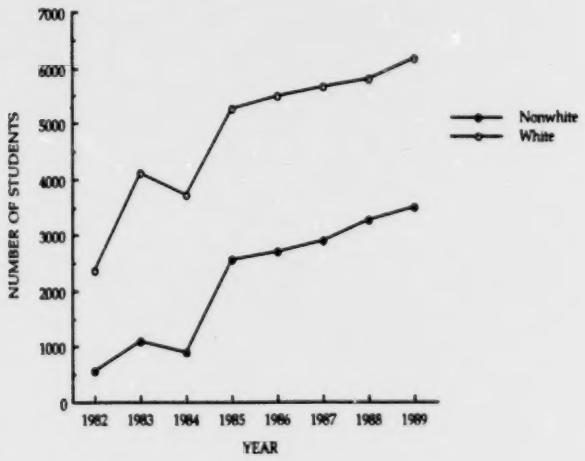
Secondary goals for the present project were as follows: (1) identify and select greater numbers and an increased proportion of underrepresented disadvantaged children; (2) test the efficacy of a battery of nontraditional micro-computerized information-processing tasks and determine, if any, the unique information-processing strengths of underrepresented children; (3) evaluate the efficacy of measures of locus of control in selecting underrepresented children for gifted programs; and (4) utilize archival data to test hypotheses about ethnic differences in the pattern of intellectual strengths. In meeting the goals of the study, the records of more than 35,000 children referred for giftedness were coded and analyzed.

The report will begin with an analysis of the primary objective: To develop an objective, reliable method of evaluating large numbers of children for giftedness that will result in equal access. Each of the four secondary goals will be addressed in Volume 2.

I. The Goal of Proportional Representation in a Gifted Program.

During the early months of the study, we monitored the selection method that already had been in progress. The method in use had evolved over several years, and had, in fact, resulted in significant increases in the percentage of nonwhites being selected for the gifted programs (see Figure 2). As Figure 2 shows, the population of nonwhites selected for the gifted program had increased substantially, in terms of both proportion and numbers.

Figure 2. White and Nonwhite GATE certified students, 1982/83 - 1989/90



A. Identification Procedures in Use Prior to the Study

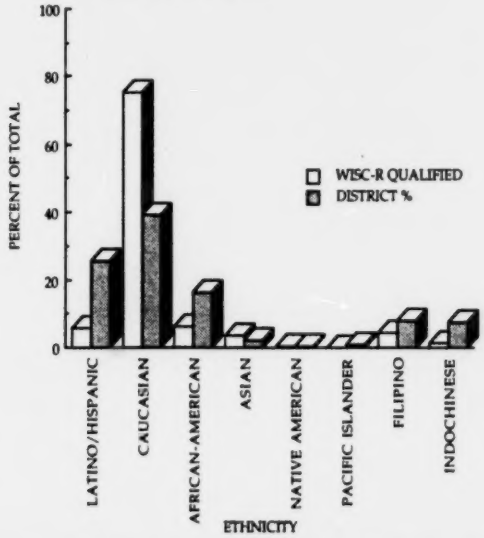
The process in use was as follows. Children were nominated for evaluation of giftedness by teachers, principals, parents, or self. In addition, central nominations were made at the GATE office of children who had obtained at least one score in the 8th or 9th Stanine on the California Test of Basic Skills (CTBS), a standardized group achievement test that was given to each child in the district at regular intervals. The purpose of central nominations was to increase referrals for potentially qualified African-American and Latino/Hispanic children, as these two groups were historically underrepresented in the nomination process. Next, all nominated children were given the Developing Cognitive Abilities Test (DCAT). The DCAT was group administered at the school site. All children who obtained a score at the 90th percentile or above on the DCAT were then referred for individual testing by one of seven (later reduced to five) school psychologists. The psychologists had a choice of administering a Wechsler Intelligence Scale for Children-Revised (WISC-R), Kaufman Assessment Battery for Children (K-ABC), or Stanford-Binet Intelligence Scale, Fourth Edition. For all but a very small percentage of children, the WISC-R was used.

To qualify for the gifted program based on intellectual achievement, a child had to obtain a score of 130 or greater (i.e., at least 2 standard deviations above the mean) on the WISC-R. In addition, the selection model took potential risk factors into account. Six risk factors were considered: (1) economic disadvantage (e.g., poverty); (2) cultural differences (e.g., limited experience with the dominant culture); (3) language (e.g., primary language of parent or student is other than English); (4) environmental disadvantage (e.g., high crime area, overcrowding, noise); (5) social/emotional (e.g., separation, divorce, or death of a parent; adjustment problems); and (6) health (e.g., asthma, childhood cancer, etc.). More recently, the district combined cultural and language risk into a single category.

Risk factors were evaluated by the use of self-report questionnaires (see Appendix I and II) sent to teachers and parents. The data were then evaluated by a school psychologist. If it was determined that a child had two or more risk factors, and the child had a Full Scale WISC-R IQ score less than 130 but greater than or equal to 120, the child was admitted into the gifted program on the basis of high potential. The consideration of risk factors was applied equally across ethnic backgrounds, and so was consistent with the single standard requirement in the selection process.

While the selection model described above had resulted in a steady increase in the proportion of nonwhites selected for the gifted program, careful monitoring within the context of the present study revealed that two groups, African-American and Latino/Hispanic, were consistently underidentified. Figure 3 shows the percentage of children selected for the gifted program as a function of ethnic background using the risk factor system and the WISC-R as the final criterion measure.

Figure 3. Ethnic composition of those certified gifted by San Diego Unified School District on the basis of WISC-R scores



As the figure shows, the WISC-R overselected Caucasians at about 100% greater than their numbers and underselected African-Americans and Latino/Hispanics at a rate of 2 to 4 times less than would be expected based on their numbers. In Volume 2, we present an in depth analysis of the WISC-R in selecting for giftedness. Our results unequivocally revealed that there is no model for using the WISC-R that can result in an equal access program, short of ethnic norms. Since no such norms exist, our data unequivocally demonstrated that the WISC-R will always result in a biased selection in favor of Caucasian and against African-American and Latino/Hispanic children. Our data revealed that the WISC-R and other highly correlated standardized intelligence tests cannot be used in an unbiased manner as a standard in selecting diverse groups of children for giftedness.

B. Monitoring The System to Obtain Equal Representation in the Evaluation Process.

In monitoring the system in use when the present project was first funded, a major problem was uncovered: under representation in the nomination process. African-American and Latino/Hispanic children, the two underrepresented groups, were not being nominated for evaluations in proportion to their numbers in the district as a whole. This under nomination of African-American and Latino/Hispanic children represented a major obstacle to the development of an equal access program.

In dealing with each of the obstacles to an equal access program, our approach was to analyze the situation and get to the root of the problem. We discovered that in the more affluent, predominantly white schools, the gifted program was seen as providing superior educational opportunities for children. Consequently, white children were referred by parents, or by teachers often with pressure from parents, in far greater numbers than would be expected based on the proportion of whites in the district as a whole. To make matters worse, there seemed to be a general lack of interest in the gifted program in many of the less affluent schools with high concentrations of Latino/Hispanic and African-American children.

One solution to the under nomination problem would have been to screen all children for the gifted program, such as all third graders. In fact, this is exactly what we proposed. Based on preliminary positive findings with the Raven Progressive Matrices Test, we proposed that all third grade children be given the Raven Progressive Matrices Test as an initial estimate of cognitive abilities. This proposal was

rejected by school administrators on the grounds that it would reintroduce comprehensive intelligence testing in the school district. Despite assurances of confidentiality, some educators in the system feared that test scores would somehow get back to teachers and create negative self-fulfilling prophecies in low IQ-scoring children.

We subsequently turned to a monitoring system, which proved to be quite effective. Each month we gathered and analyzed the data pertaining to the proportion of children tested as a function of ethnic background. We then created bar graphs that compared the proportion of children tested to their proportion in the district for each ethnic background (see Figures 4 and 5).

Figure 4. Percent tested versus percent in the district 3/1/91

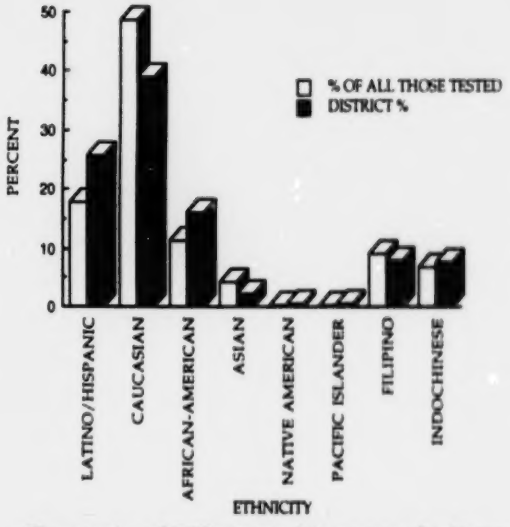
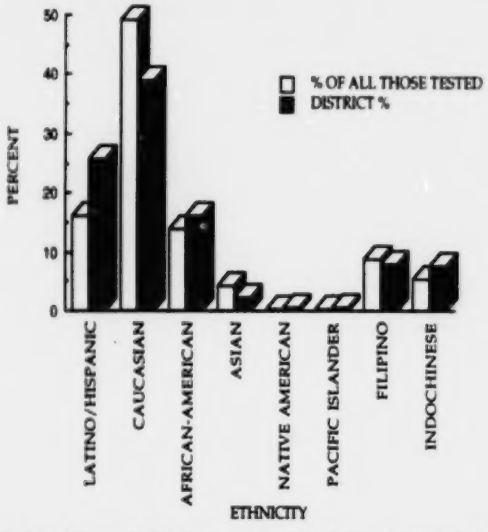


Figure 5. Percent tested versus percent in the district 4/10/91



Figures 4 and 5 illustrate this approach. For each ethnic background there are two bar graphs. The first shows the percentage of children from that ethnic background who were nominated and tested for giftedness. The second shows the actual percentage of children from that ethnic background in the district as a whole. These figures provided clear, graphic data that illustrated that African-American and Latino/Hispanic children were underrepresented in the nomination process, and that white children were overrepresented. The monitoring procedure led to an awareness of the problem within the school district that ultimately led to change.

A major effort was made to increase referrals for qualified African-American and Latino/Hispanic children. Training sessions were held for teachers. The teachers were made aware that the two underrepresented groups were not being referred in proportion to what would be expected based on a model that assumes giftedness is evenly distributed in the population across ethnic backgrounds. They were given instruction in cultural differences and participated in discussions on how to spot potential giftedness in African-American and Latino/Hispanic children. In addition, a central nomination procedure was used at the GATE Administrative Office in which all high achieving African-American and Latino/Hispanic children, as evidenced by scores above the 50th percentile on standardized achievement tests, were included in the screening process. Finally, the GATE psychologists took an active role in soliciting nominations from individual schools. For example, one psychologist reported going to a predominantly African-American school where not a single African-American had been nominated for giftedness testing. The psychologist insisted that the school provide its top 100 African-Americans for evaluation. Of these, 33 scored two standard deviations above the mean on the Raven Progressive Matrices Test!

Figures 6, 7, and 8 illustrate the success of the monitoring in terms of equal access in the evaluation process. The figures show the proportion of Latino/Hispanic, African-American, and Caucasian children evaluated, respectively, for three time periods: 9/89-6/90 (a baseline measure that represents the proportion tested prior to the monitoring process), 9/90-6/91 (the first year of the project),

and 9/91-6/93. For each bar graph, proportional representation is determined by dividing the proportion of children evaluated for any given time period by their proportion in the district as a whole.

As inspection of Figure 6 indicates, the proportion of Latino/Hispanic children nominated for evaluation of giftedness increased steadily throughout the three periods, from just over 0.6 prior to the monitoring process to approximately 0.8 by the end of the first year to nearly 1.0 as of this writing. For the first time in the history of the San Diego Unified GATE program, Latino/Hispanic children are being nominated and evaluated for the gifted program in proportion to their numbers in the district.

Figure 6. Proportionate representation of Latinos/Hispanics evaluated, as opposed to their representation in the population

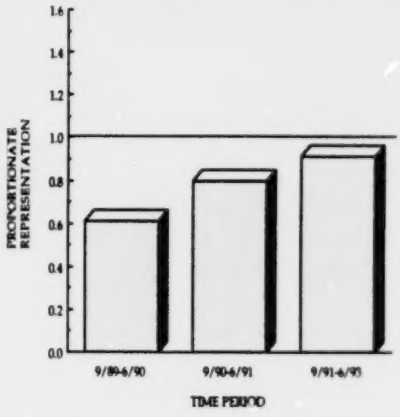
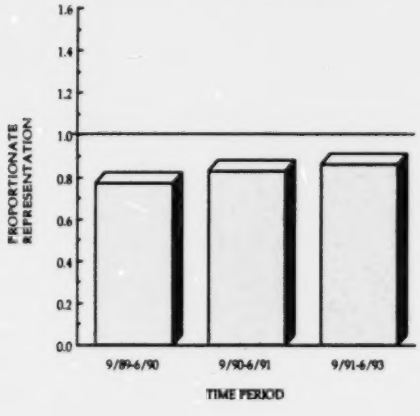


Figure 7. Proportionate representation of African-Americans evaluated, as opposed to their representation in the population



Inspection of Figure 7, which illustrates the proportion of African-American children referred and evaluated for each of the three time periods, shows that there was a steady increase in the proportionate representation of African-Americans.

Finally, Figure 8 reveals that the proportion of Caucasians referred and evaluated fell from a substantial overrepresentation to a slight overrepresentation at the present time.

Figure 8. Proportionate representation of Caucasians evaluated, as opposed to their representation in the population

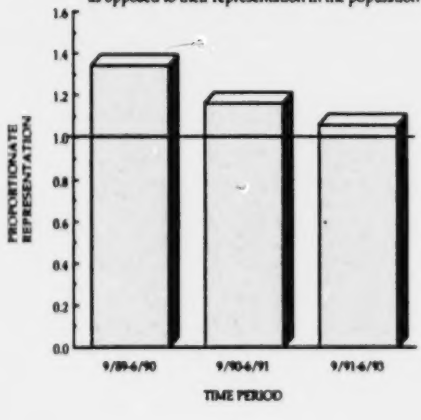
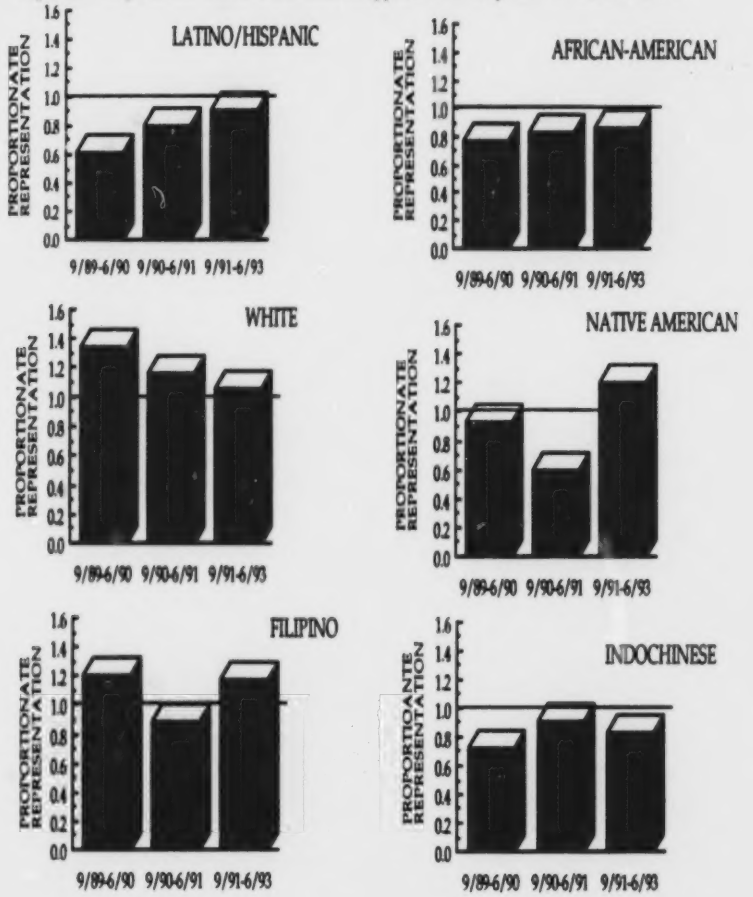


Figure 9 provides a summary of the proportion of children nominated and evaluated for the gifted program for each of the three time periods through 6/93 for six ethnic backgrounds: Latino/ Hispanic, African-American, White, Native American, Filipino, and Indochinese. As the figure shows, while there was never a perfect representation, it was possible to ameliorate all major inequities. From our data and experience, we draw the following conclusion: **The attainment of equal representation in the proportion of children nominated and evaluated for giftedness across ethnic background is a realistic and readily attainable goal for any school district.**

Figure 9.
Proportionate representation of those evaluated, as opposed to their representation in the district



C. The Shift to the Raven Progressive Matrices Test

As previously indicated, our monitoring of the selection process quickly revealed the inappropriateness of the Wechsler Intelligence Scale for Children-Revised (WISC-R) as the standard for giftedness in the ethnically diverse San Diego City School District (see Figure 3). Using ongoing records as well as archival data from approximately 15,000 cases evaluated for giftedness between 1985 and the present, we conducted a thorough analysis of the WISC-R. Detailed results of this analysis appear in Volume 2. In brief, the results revealed that there was no model (e.g., weighted subtests, use of different subtests for different ethnic groups, etc.) of use of the WISC-R that produced equal access. When we provided this information to the GATE psychologists and administrator in early 1991, the district modified its selection policy and added the Raven Progressive Matrices Test as one of the standardized tests that could be used to certify a child as gifted. This modification represented

a change in the original design of our study, which had called for one full year of monitoring to establish a baseline. Those who were in charge of the San Diego City Schools GATE program decided that since we knew the procedures presently in progress were doomed to fail in terms of providing equal access, there was a need for an instant policy change. From a scientific standpoint, a midyear shift in selection procedures might reduce the rigor of our ultimate findings. From a practical standpoint, however, it made no sense to continue using biased procedures.

1. Characteristics of the Raven

The use of the Raven Progressive Matrices (RPM) test was indeed well founded. As Carpenter, Just, and Shell (1990) put it, the Raven provides a measure of "the ability to reason and solve problems involving new information, without relying extensively on an explicit base of declarative knowledge derived from either schooling or previous experience" (p. 404). Theoretically, the Raven provides a measure of "fluid intelligence", in contrast to "crystallized intelligence", which reflects previously acquired skills (Cattell, 1963). Despite its relative independence of previous experience and its nonverbal format, Raven test scores correlate highly with measures of intellectual achievement (Court & Raven, 1982), which suggests that the underlying processes are general rather than specific to this one test.

For years researchers in the United States had pointed to the RPM as among the most promising of the nontraditional approaches for assessing giftedness in ethnically diverse groups. The RPM provides a nonverbal measure of intellectual functioning that minimizes the effects of language and culture (Baska, 1986; James, 1984; Powers & Barkan, 1986; Carpenter et al, 1990). Until recently, however, the RPM could not be applied on a widescale basis due to the absence of adequate norms.

In 1986 the manual for the RPM was updated along with the publication of an impressive set of norms that included smoothed norms for Americans, a variety of ethnic norms, and international norms from major world cities (Raven and Colleagues, 1986, 1990). Moreover, as Baska (1986) has noted, the RPM not only has been shown to be effective in identifying gifted minority students, it has also correlated well with success in the Chicago City School System. A variety of research studies have supported the use of the RPM for children from culturally diverse backgrounds (Karnes, Lee, & May, 1982; Powers, Barkan, & Jones, 1986; Sidles & MacAvoy, 1987).

There are several forms of the Raven, including a colored form for very young children, the Standard 60 item test, and the advanced test for the very highest levels of abilities in adolescents and adults. All forms consist of the same type of problem, the incomplete matrix. The child is shown a design with a distinct pattern that may be based on form, number, size, and a variety of other organizing principles. A part of the pattern is omitted and the child must select from among six to eight alternatives, and choose the one that accurately completes the pattern.

According to a detailed theoretical and empirical analysis by Carpenter et al (1990), the Raven measures a basic ability underlying intelligence as follows: "to decompose problems into manageable segments and iterate through them, the differential ability to manage the hierarchy of goals and subgoals generated by this problem decomposition, and the differential ability to form higher level abstractions" (p. 429).

An extensive body of research reported in the test manual reveals that the RPM is about as reliable as the WISC-R. Validity studies have revealed that the RPM measures general intelligence, and is perhaps the single best measure of Spearman's g factor (Marshalek, Lohman, & Snow, 1983; Snow, Kyllonen, & Marshalek, 1984).

To digress for a moment, Spearman's g factor (Spearman, 1927) is one of the most robust findings in the field of testing. Its existence is based on the well known phenomenon that all tests of intelligence and scholastic aptitude are positively correlated, with a general range from about .60 to .90, and a mean coefficient of about .75 (see Carroll, 1992; Humphreys, 1992; Jensen, 1992). When the matrix of correlations among diverse but correlated tests of intelligence and aptitude are subjected to a hierarchical factor analysis, it is almost always found that at least half the variance can be accounted for by a common factor, which Spearman (1927) called g and interpreted in terms of general mental energy.

Because the RPM measures g, it correlates with other measures of general intelligence including language abilities and reading, even though the RPM itself contains no language or reading problems. Moreover, because it does not involve reading, language, or other aspects of acquired, or crystallized intelligence, the Raven is a far better measure of pure potential than tests such as the WISC-R, whose scores depend heavily on acquired knowledge.

In Volume 2 we present a number of important findings pertaining to the Raven that further support its validity. For now, just one example will be given. From our database we evaluated the records of more than 2,000 children who had been given both a Raven and a WISC-R. Scores on the Raven and WISC-R were then correlated with scores on the California Test of Basic Skills (CTBS), a Standardized Test of Achievement in Language, Reading, and Math. For both African-American and White children, the Raven was a better predictor of language achievement than the WISC-R Verbal, Performance, or Full Scale IQs. Such results are probably due to the Raven's ability to evaluate potential independently of past learning.

2. Initial Shift to the Raven

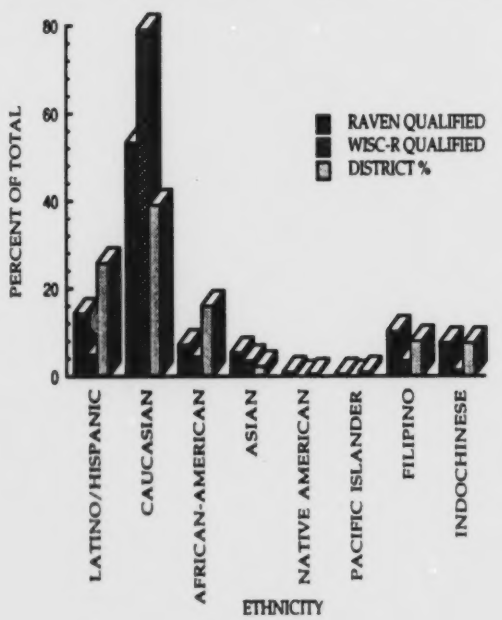
By about March or April of 1991, the Raven was added to the evaluation tools for every GATE psychologist. Initially, the psychologists took a cautious approach. They tended to use the Raven for nominated nonwhite students only after the student failed to met the cut-off on the WISC-R. Approximately 50% of the nonwhite children who had failed to qualify based on a WISC-R qualified with the Raven.

3. The Adoption of the Raven as the Primary Certification Tool.

In September of 1991 the district changed its identification procedures based on the initial positive results with the Raven. The DCAT, the group screening test, was completely eliminated from the process. The nomination process, which had resulted in children being referred for giftedness testing almost in proportion to their numbers, was retained. Also retained was the risk factor system. The major change was that all children referred for giftedness were group-tested with the Raven and ultimately qualified, or did not qualify, based on their Raven score. A child with only one or no risk factors needed a Raven IQ equivalent of 130 or greater to qualify for the gifted program; a child with 2 or more risk factors needed an IQ of 120 or greater to qualify.

Figure 10 shows the result of the shift to the Raven (compared to the WISC-R), and the dramatic effect its use had in the percentage of traditionally underrepresented children enrolled in the program.

Figure 10. Ethnic composition of those certified gifted by San Diego Unified School District on the basis of WISC-R (1984-1990) versus Raven's Progressive Matrices (1990-1993)



Figures 11-17 show comparisons of the Raven versus the WISC-R for specific populations. These figures dramatically illustrate the selection bias in the WISC-R and a corresponding lack of bias in the Raven.

Figure 11. Achieving equity in gifted representation.....Latino/Hispanic population

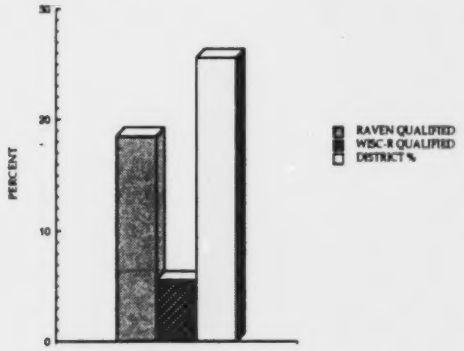


Figure 11 reveals that 26.6% of the population are Latino/Hispanic. Whereas only 5.6% of the children selected for giftedness with the WISC-R were Latino/Hispanic, 18.5% of those certified with the Raven were Latino/Hispanic. Thus, use of the Raven resulted in an increase of over 330% selection of Latino/Hispanic children for the gifted program.

Figure 12. Achieving equity in gifted representation.....Filipino population

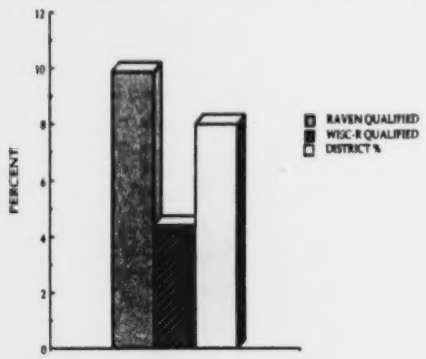
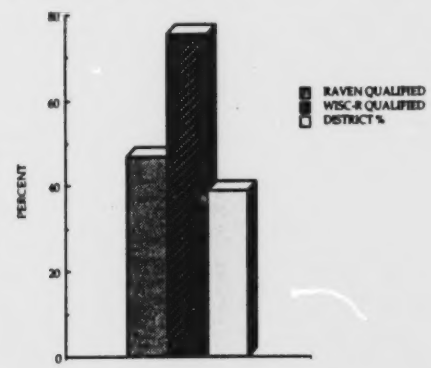


Figure 12 reveals that 8% of the population are Filipino. Whereas 4.4% of the children selected for giftedness with the WISC-R were Filipino, 9.9% of those selected with the Raven were Filipino.

Figure 13. Achieving equity in gifted representation.....Caucasian population



In Figure 13 it can be seen that compared to a district population of 39%, 75.5% of the individuals selected for the gifted program were Caucasian when the WISC-R was used. With the Raven, this percentage dropped to 47.1.

Figure 14 is quite dramatic. Although Indochinese represented 7.7% of the total population, only 1.5% of those selected with the WISC-R were Indochinese. With the Raven, there was more than a 500% increase and these children were selected approximately in proportion to their numbers in the district as a whole.

Figure 14. Achieving equity in gifted representation.....Indochinese population

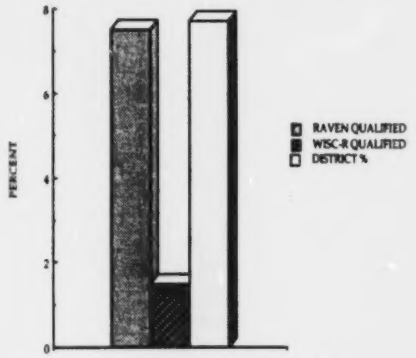


Figure 15. Achieving equity in gifted representation.....African-American population

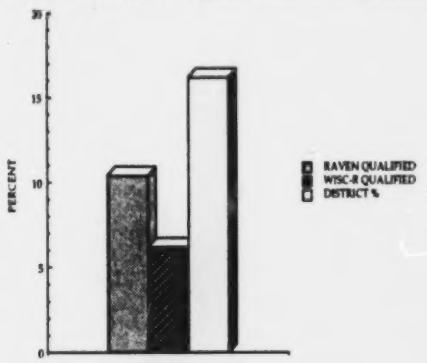


Figure 15 reveals that compared to a percentage of 16.2 in the district, only 6.2% of the children selected for the gifted program were African-American when the WISC-R was used. This figure jumped to 10.4% with the Raven -- a 168% increase for these traditionally underrepresented children.

Figure 16 shows the familiar pattern of marked changes toward increased equity with the Raven. Comprising .7% of the district, Pacific Islanders represented only .2% of the gifted population selected with the WISC-R -- an underselection of 350%. With the Raven, these children were selected at slightly above their proportion in the district.

Figure 16. Achieving equity in gifted representation.....Pacific Islander population

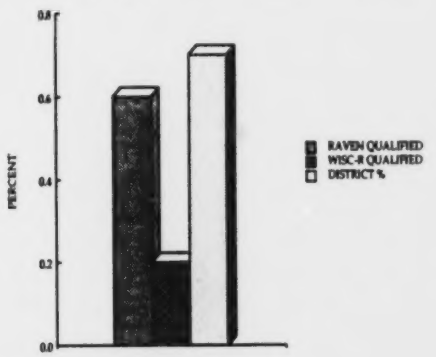


Figure 17. Achieving equity in gifted representation.....Native American population

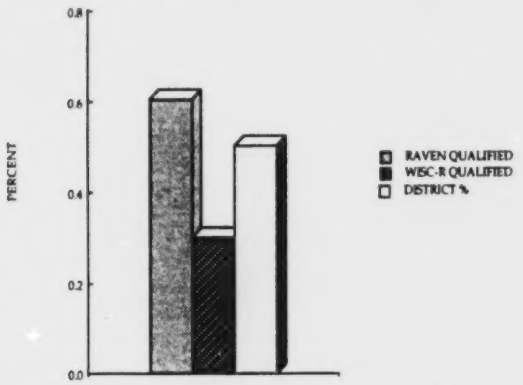


Figure 17 shows that results for Native American children paralleled those results for Pacific Islanders. From a substantial underrepresentation with the WISC-R, these children were selected at a rate that was slightly above expectation when the Raven was used.

Figure 18. Nonwhite student enrollment in GATE, 1986 - 1993

Figure 18 provides a graph of the nonwhite enrollment in the GATE program. Notice the dramatic, nearly hyperbolic increase that occurred in the percentage of nonwhites enrolled in the GATE program between 1990 and 1993.

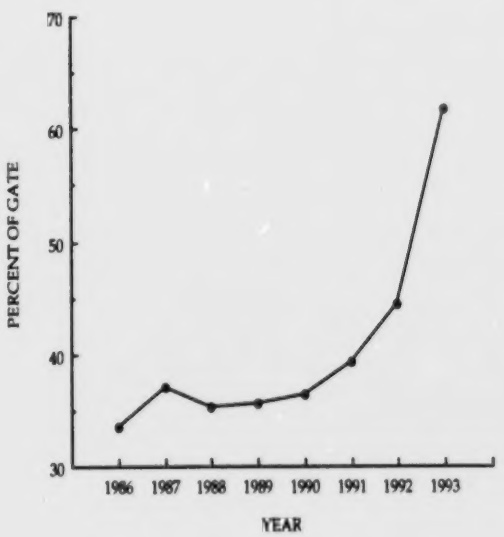
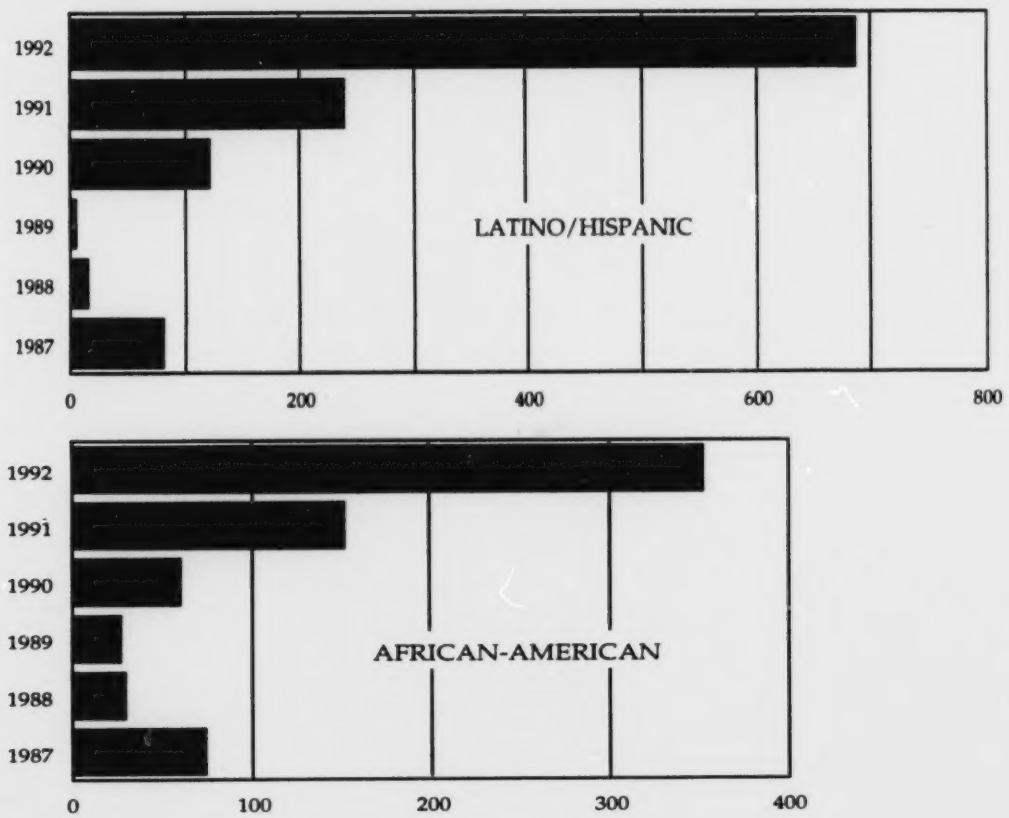


Figure 19 shows the growth in numbers of Latino/Hispanic and African-American children certified as gifted for each year between 1989 and 1992. Notice that the growth in Latino/Hispanic children enrolled in the GATE program multiplied almost 70-fold from 1989 to 1992. The African-Americans, likewise, saw their rate of growth increase dramatically, with approximately an 8-fold increase between 1989 and 1992. In 1989 40 African-Americans were added to the GATE program. By 1992 that number had grown to 350, while the proportion of African-Americans in the district remained steady. For Latino/Hispanic children, almost 700 were added to the GATE program, compared to less than 10 for 1989.

Figure 19. Growth in numbers of traditionally underrepresented children certified for GATE



D. Emergent Problems

The dramatic increases in the number and proportion of Latino/Hispanic and African-American children was not uniformly well-received. In fact, there was a political upheaval among some of the more affluent white parents. Recall that many white parents viewed the gifted program as a superior educational system for their children. Even though Caucasian children continued to be evaluated and certified at least in proportion to their numbers, many white parents, including some whose own child failed to be certified for the GATE program, complained forcefully.

Some parents wrote to the school board, while others called for the termination of the GATE administrator and the present research program. Some parents recruited psychologists and statisticians from the community to critique and refute the Raven. The Los Angeles Times did an investigation and wrote an article. In the end, there was a move to combine the GATE program with the special

education program, presumably so that there could be a return to the old order. The move to combine the two programs was successful, and the GATE program joined special education in an Exceptional Programs Department. However, there have been no changes to date in the methods of identification outlined herein.

A second problem that emerged was that teachers of GATE children were not prepared to deal with the large influx of high potential African-American and Latino/Hispanic children who, while gifted, did not fit the mold of the more affluent children who had previously been certified as gifted with the WISC-R. Prior selection procedures, in using tests such as the WISC-R and other verbally weighted standardized tests of crystallized ability, tended to identify a relatively homogeneous population of high achieving, well-motivated, verbally mature children. While many of these children are indeed of high potential, a significant proportion are simply verbally advanced due to the enriched experiences available to affluent children. In contrast to these verbally mature children, there exists a significant number of disadvantaged children with extremely high potential, but limited achievement.

In switching to the Raven Progressive Matrices Test, we began to identify children with high potential, but not necessarily high achievement. The result was greater diversity in the classroom, but new problems for teachers. To help teachers deal with this new diversity, we held seminars for teachers. However, much more effort will be needed if these more culturally diverse children are to be successfully integrated into the gifted program.

In Volume 2, we present the initial drafts of research manuscripts that have resulted from this project. While it is our intent to publish each of these manuscripts in professional journals, we present them in Volume 2 in order to provide rapid dissemination of our findings to interested readers. In Chapter 1 of Volume 2, we present our major findings pertaining to the Raven. Chapter 2 represents a doctoral dissertation pertaining to the WISC-R written by Nancy E. Johnson in partial fulfillment of the requirements of the Doctor of Philosophy degree.

Chapter 3 provides an overview of data relevant to risk factors. In Chapter 4 we present our major findings pertaining to information-processing. Chapter 5 discusses our results relevant to locus of control. Finally, Chapter 6 provides a discussion of the characteristics of gifted underachievers.

Our primary limiting factor is that funding for this grant ended on 12/31/93. Given the considerable amount of data that we have accumulated, we will continue to analyze and disseminate our findings during the next few years.

APPENDIX I

San Diego City Schools
Educational Services Division
Gifted and Talented Education

TEACHER NOMINATION FORM

Date_____

Name_____ Birth Date_____ Sex_____Ethnic Code_____

School_____ Grade____Track _____Room Number_____

SOCIAL/ENVIRONMENTAL VARIABLES

Please check all items that apply:

1. ENVIRONMENTAL
   - _____ Lacks preschool/kindergarten experience
   - _____ Irregular attendance
   - _____ Transiency (3 or more school moves)
   - _____ Limited home enrichment opportunities (availability of books, periodicals, family interaction, family outings)
   - _____ Home conflicts:
     - _____ Responsibilities and study time
     - _____ Excessive child care responsibility
     - _____ Working to help support family
     - _____ Overcrowding — no study area
     - _____ Inconsistencies in the home
2. ECONOMIC
   - _____ Economic hardship
   - _____ Single parent head of household
   - _____ Unemployment
3. LANGUAGE
   - _____ Primary language of parent and/or student is other than English
   - _____ Not proficient/fluent in English
   - _____ Uses non-standard English
   - _____ Student enrolled in Second Language Immersion Magnet (SLIM)
4. CULTURAL
   - _____ Limited home/school communication
   - _____ Experience in dominant culture is limited
   - _____ Cultural values and beliefs differ from dominant culture

SOCIAL/ENVIRONMENTAL VARIABLES

Page 2

5. SOCIAL/EMOTIONAL

_____ Child abuse: physical_____ mental_____ neglect_____

_____ Emotional/adjustment problems

- _____ Working with district counselor
- _____ Working with social worker
- _____ Utilizing psychological services
- _____ Other:_____

_____ Significant home factors

- _____ Separation
- _____ Divorce
- _____ Death

_____ Extended absence of parent

- _____ Military
- _____ Employment
- _____ Other:_____

_____ Family

- _____ Single parent
- _____ Remarriage/step-parent

6. HEALTH

_____ Designated instructional services

- _____ PHDIS
- _____ Speech and language
- _____ Vision
- _____ Hearing
- _____ Adaptive P.E.

_____ Severe allergies

_____ Asthma

_____ Frequent medical/health referral

_____ Regularly prescribed medication

_____ Other:_____

Prepared by_____ Recommended? Yes_____ No_____

(Teacher)

Reviewed by_____ Recommended? Yes_____No_____

APPENDIX II

San Diego City Schools
School Services Division
Gifted and Talented Education

STUDENT/PARENT INFORMATION FORM

Student Name: Date_____

_____Birth Date_____Sex___School_____
(Last) (First) (mi)

Address_____Mother's name_____Occupation_____
(Street) Work Phone_____

_____Father's name_____Occupation_____
(City) (State) (Zip) Work Phone_____

Grade_____ Room Number_____ Track_____ Home Phone_____

Schools Attended Grade Dates Attended

_____

_____

_____

1. Names and ages of brothers and sisters:_____

_____

2. Describe your child's attitude toward school:_____

_____

3. List any special interests, talents, and skills your child may have:_____

_____

4. What special lessons, training or learning opportunities has your child had outside of school?

_____

_____

5. To help us know more about your child, please check any of the following that apply:

- ❑ allergies
- ❑ asthma
- ❑ frequent absences
- ❑ prescribed medications
- ❑ parent in military
- ❑ frequent parent absence
- ❑ parents separated
- ❑ single parent
- ❑ remarriage/step-parent
- ❑ recent death/significant illness in family
- ❑ 3 or more schools attended
- ❑ no kindergarten or pre-school experience
- ❑ additional language(s) spoken in home List:_____

6. Has your child been previously assessed? ❑ yes ❑ no If yes, when?_____

7. What other things would you like us to know that would assist us in assessing your child?

_____

_____

Name of person completing this form_____ Relationship to student_____

APPENDIX III

In Search of An Equal Access Model:
Review of Saccuzzo's "Identifying Underrepresented Disadvantaged GATE Children"

Margie K. Kitano
San Diego State University

---Invited article submitted to Gifted Child Quarterly

Abstract

"Identifying Underrepresented Disadvantaged Gifted and Talented Children: A Multifaceted Approach" is a collaborative research and development project that examined alternative procedures in search of an equal access model for identifying underrepresented gifted students. A review of the project was conducted using interviews with key participants and project-generated manuscripts and publications. The project analyzed archival and current data on some 35,000 students to evaluate a large, urban school district's selection process from referral to certification as gifted. Based on the findings, a new model designed to increase the proportion of ethnically and economically diverse students referred for assessment and identified as gifted was implemented and evaluated. The new model incorporates the Raven Progressive Matrices as the criterion measure of intellectual ability. Project data demonstrate that the new model has increased the number and proportion of underrepresented students referred and selected for gifted programs but has not met the criterion for providing equal access. Use of the Raven has led to certification of students with high cognitive ability, although not necessarily commensurate academic achievement, and to a decrease in the proportion of mainstream students certified as gifted. The review found diverse perspectives on the interpretation of these outcomes. It is clear that the project has had major impact on district practices and has increased access for gifted students from ethnically, linguistically, and economically diverse backgrounds.

In Search of An Equal Access Model: Review of Saccuzzo's "Identifying Underrepresented Disadvantaged GATE Children"

In 1982, what is now the eighth largest school district in the nation observed a significant racial imbalance in its gifted and talented education (GATE) program and set a course for change. The district had an early awareness of the growing ethnic and linguistic diversity of its population and the underrepresentation of nonmainstream students receiving services for the gifted. To find more equitable identification and selection procedures, the GATE leadership conducted a comprehensive search of extant literature and consulted other large urban districts, state and federal departments of education, and national leaders in the field. Concurrently, the GATE program instituted a central nominating process and inservice opportunities for teachers and administrators, requested that a team of school psychologists be assigned to the GATE program, and sought to diversify its staff. Risk factors (e.g., environmental disadvantage) that impact test taking performance were added to standardized test criteria for certification as gifted.

These changes significantly increased the numbers of diverse students served in programs for the gifted. However, they continued to be underrepresented relative to their proportions in the district. Meanwhile, the state's recession-related financial crisis combined with competing concerns voiced by unions, community advisory groups, parents, and educators seriously threatened to dismantle the GATE program. Within this context, the Javits-funded project titled "Identifying Underrepresented Disadvantaged Gifted and Talented Children: A Multifaceted Approach" began in the fall of 1990 to establish an equitable identification procedure with strong empirical documentation. According to the senior GATE administrator, had it not been for the timely implementation of the Javits project, "there would be no gifted program in this school district" today.

This article provides a review of the project based on two major sources of information. First, manuscripts, publications, and documents from conference presentations given by project and school district staff were examined (Saccuzzo, 1993; Saccuzzo & Johnson, 1992, undated; Saccuzzo, Johnson, & Guertin, 1993; Saccuzzo, Johnson, & Russell, 1992). Second, the reviewer conducted face-to-face or telephone interviews with the three key project staff members and with school district personnel including the senior GATE administrator, three GATE school psychologists and counselors, and four elementary and secondary school principals. The interview findings suggest that project activities and findings can be objectively described. Further, most informants agree that the project has dramatically impacted school district policies and procedures with regard to increased enrollment of students from ethnically diverse backgrounds in programs for the gifted. At the same time, these changes have generated healthy debate regarding what constitutes an equitable identification process as well as what constitutes gifted potential. This review begins with a description of the project and its findings and then examines multiple perspectives regarding project outcomes and future challenges.

Project Description

"Identifying Underrepresented Disadvantaged Gifted and Talented Children: A Multifaceted Approach" represents a 3-year cooperative research and development effort between a large urban school district and a comprehensive state university. Dennis P. Saccuzzo, professor of psychology at San Diego State University, serves as prinicipal investigator and director. The San Diego Unified School District's Gifted and Talented Education program, under the leadership of David P. Hermanson, functions as the collaborating partner. The project focuses on evaluating strategies for identifying for gifted programs students traditionally underrepresented in such programs; collaterally, it considers the realistic needs of a highly diverse school district in a state undergoing severe economic stress. The district serves over 123,000 students, of whom approximately 29 percent are Latino, 38 percent white non-Hispanic, and 18 percent African-American. The remaining 15 percent are of other backgrounds, primarily Filipino, Indochinese, Asian, Pacific Islander, and American Indian. This review was conducted in the latter half of the project's third and final year.

Purposes

The project has as its primary purpose to determine whether an objective, reliable selection model can be developed that will provide equal access to gifted programs for children of all ethnic and economic backgrounds. Equal access is defined as selection of students in each ethnic or cultural group in proportion to their numbers in the school district as a whole. The project also sought to enable the school district to identify and select for gifted programs greater numbers and proportions of underrepresented and disadvantaged students as defined by Javits legislation.

Three additional goals focus on exploring characteristics of underrepresented students on various assessment devices and evaluating the potential of nontraditional measures for identifying students as gifted. Specifically, project staff have analyzed archival data on 20,000 children referred for gifted assessment since 1984 to test hypotheses about ethnic differences in patterns of intellectual strengths on the WISC-R. The data bank now includes information on some 35,000 elementary to high school-age students. Additionally, they sought to test the efficacy of a battery of nontraditional micro-computerized information-processing tasks and determine the information-processing characteristics of ethnically diverse students. Finally, they investigated the potential of a locus of control measure for identifying giftedness in target students.

Procedures and Findings

The purposes and goals are being implemented by the project's director, post-doctoral fellow, and coordinator with the assistance of thirty-four university students who have served as research assistants. Three types of data were analyzed: standardized test data on students referred since 1984 as potentially gifted; numbers of students from various ethnic groups referred, nominated, and certified over the project's duration as gifted; and performance scores on a battery of nontraditional assessment devices. Findings related to each of the five project purposes are described in the following sections.

Evaluating the efficacy of pre-project identification measures: the WISC-R. Prior to the project's implementation, students were nominated for evaluation by teachers, principals, parents, or self or through performance on the California Test of Basic Skills. Nominated students received group administration of the Developing Cognitive Abilities Test (DCAT). School psychologists administered an individual intelligence test, most frequently the WISC-R, to those students who scored at the 90th percentile or above on the DCAT. Because the WISC-R surfaced as the predominantly used criterion measure for certification as gifted in the district, the project examined the potential of the instrument for unbiased selection. Archival WISC-R data were analyzed for a subset of elementary students referred as potentially gifted from African-American, Asian-American, Caucasian, Filipino, and Hispanic backgrounds. The project found no single model or combination of individual models using WISC-R subtest scores that could select equally from each of the five groups. The researchers concluded that no single model (i.e., not using ethnic norms) of WISC-R scores will result in an equal access program. The data suggest that the WISC-R overselects Causcasian and underselects African-American and Latino students for gifted programs (Saccuzzo & Johnson, 1992, Presentation #4).

Finding an equal access model and increasing the numbers and proportions of diverse students identified as gifted. During the first implementation year, the project found that one barrier to equal access occurred during the referral and nomination stages. Specifically, school personnel and parents were not nominating African-American and Latino students in proportion to their numbers in the district as a whole. Project staff systematically gathered, analyzed, charted, and disseminated to district personnel data on the proportion of students tested by ethnic group. In collaboration with GATE personnel, a program was implemented to monitor and share nomination data, provide teacher inservice, and actively engage GATE psychologists in soliciting proportionate nominations. The program led to a steady increase in the proportions of African-American and Latino students tested for GATE programs and a decrease in the overrepresentation of Caucasian students.

In addition, given the project's findings on the WISC-R, the district added the Raven Progressive Matrices (RPM), 1986 American norms, as one of the standardized tests that could be used to certify a student as gifted. The RPM (Raven & Summers, et al., 1986) is an untimed, 60-item non-reading test of

general mental ability. Each item presents a design with a part missing and several choices from which the missing piece can be selected. The RPM can be administered in a group or individual setting. As the project progressed, the DCAT was eliminated as a screening measure and a psychologist-administered RPM adopted as the prescribed certifying tool. A score of 98 percentile, or 90 percentile with two or more risk factors, was retained as the criterion for documenting intellectual ability (see San Diego City Schools, 1992 for additional information). Project data demonstrate that, combined with increased ethnic nominations, the shift to the RPM dramatically raised the number of diverse students enrolled in GATE programs. For example, the number of Latino students enrolled increased 70-fold from 1989 to 1992 and the number of African-American students 8-fold over the same period (Saccuzzo, 1993). Using the RPM, the project identified for gifted programs over one thousand African-American and Latino students who would not have been selected through WISC-R performance.

Proportional representation in enrollment in programs for the gifted also improved. Proportional representation is calculated by dividing the proportion of students enrolled from a given group by their proportion in the district as a whole, such that 1.0 represents the standard criterion. Prior to the project's implementation, the representation of white students was 1.5 (i.e., they were overselected for gifted programs by .5 relative to their proportion in the district as a whole). The representation of Latino students was 0.5 (underselection by .5), and of African-American students 0.33 (underselection by .67). At the time of this review, project data show the proportion of white students enrolled in gifted programs as 1.2, Latinos as 0.8, and African-American students as 0.7. Additionally, implementation of the project model has increased the proportionate representation of Filipino, Indochinese, Pacific Islander, and American Indian students selected for gifted programs and has produced a slight overrepresentation of Filipino and Asian-American students.

The project staff also evaluated records of over 20,000 second- through sixth-grade students in the data base who had been administered either the RPM or WISC-R or both. These data were correlated with language, reading, and math scores for the same students on the California Test of Basic Skills, DCAT, and Abbreviated Stanford Test of Achievement. Results suggest that the RPM provides a better predictor of academic achievement, including language achievement, than the WISC-R verbal, performance, or full scale IQ scores for African-American and Latino students (Saccuzzo & Johnson, 1992, Presentation #5).

Assessing the potential of nontraditional instruments for identifying gifted students. The project also evaluated the efficacy of the Nowicki-Strickland locus of control measure (Saccuzzo & Johnson, 1992, Presentation #1) and a battery of micro-computerized information processing tasks for use in selecting diverse students as gifted (Saccuzzo & Johnson, 1992, Presentations #2,3; Saccuzzo, Johnson, & Guertin, 1993). Included in the latter were information processing tasks that measured speed of processing as well as tasks not dependent upon speed. In general, these studies produced information about differences and similarities by ethnic and by ability (gifted/nongifted) group. The project team concluded that, while some of these measures have potential, more work needs to be done in this area.

Project Outcomes: Multiple Perspectives

This section examines informants' various interpretations of the project's findings and impact. Diverse perspectives were found on two major issues: (a) whether the project successfully identified an equal access identification model using a single standardized measure and criterion across ethnic groups; and (b) whether the students identified through the model are "gifted."

Does Proportionate Nomination and the RPM Produce Equal Access?

The project's major purpose was to determine whether a selection model could be developed that would provide equal access to gifted programs for students of all ethnic and economic backgrounds. When asked whether the Raven Progressive Matrices provided an equal access selection model, Project Director Dennis Saccuzzo responded "No, if the RPM is used in a standardized format with an ethnically and economically diverse population. Use of the RPM improves access, but does not produce equal access." Project staff have concluded from their data that attainment of proportionate representation

across ethnic and economic groups through monitoring and inservice for *nomination* to gifted programs constitutes a realistic, attainable goal. Moreover, proportionate nomination in conjunction with selection through use of the RPM significantly increased the numbers and proportion of ethnically and economically diverse students *enrolled* in programs for the gifted, thus meeting the second primary purpose of the project. However, they evaluate the model implemented in the district through the project as not meeting the objective of producing *equal access* to gifted programs, since there continues to be significant underrepresentation (by .3) of African-American students relative to their proportions in the district as a whole. According to the research team, blanket use of the RPM or any other standardized psychometric test will not produce equal access. They hypothesize that use of the RPM in combination with dynamic assessment (Feuerstein, 1979) may lead to an equal access model.

GATE personnel, under pressure from the district and community to increase the number and proportion of ethnically diverse students in gifted programs, offer a different perspective on project outcomes. When asked if the goals have been met, the senior school psychologist replied, "Yes; very nicely, especially if you consider the entire process from nomination to certification. I was skeptical in the beginning but have been thoroughly won over by the results. All of us feel comfortable going out anywhere and defending the practice."

Both project and GATE personnel report that some members of the community have been vocally critical of project outcomes. For example, despite the continuing overrepresentation of white, nonHispanic students selected for gifted programs, the proportion of white students nominated and identified has declined with the implementation of the new model. For this reason, some parents argue that the RPM is biased against mainstream students. One principal noted that parents whose children qualify on the WISC-R but fail to qualify on the RPM (and therefore for the GATE program) question the model's validity.

Project and GATE personnel also report that members of the African-American community have objected to the model because standardized tests traditionally have been used to discriminate against their children and because the RPM has not eliminated bias in selection. On the other hand, the dramatic increase in number and proportion of African-American and Latino students identified through the project has produced many positive comments. The principal of a school with high enrollments of Latino students (88%) and students whose first language is not English (50%) reported a substantial rise in the number of students from these groups served by GATE and "no complaints from parents." The principal of a school whose students are 39 percent African-American and 29 percent Latino described the RPM as an "excellent instrument" compared to the Wechsler and Binet and offered that "parents have been extremely pleased and positive."

Does the Model Identify Gifted Students?

Informants agree that the combination of increased nomination and use of the RPM as the criterion measure has raised the numbers and proportions of traditionally underrepresented students in the GATE program. Opinions differ regarding the nature of students identified as gifted by the Ravens as opposed to the Wechsler. The question has arisen because some of the students certified by the Ravens display achievement characteristics different from those certified by language-based tests. Specifically, the earlier nomination practices and use of verbally weighted tests, such as the WISC-R, tended to identify high achieving, academically motivated students. Implementing the new model using the RPM leads to identification of students with high cognitive potential but not necessarily high academic achievement.

The academic, cultural, and economic diversity exhibited by students selected through the project's model has presented new challenges to GATE teachers. The principal of one ethnically diverse school reported that the teachers consider the Ravens "a step backward" because so many of the students lack competitive academic skills and are "not ready for GATE materials and curriculum." This informant suggested that "a battery may be more appropriate. I'm not sure if we are truly identifying disadvantaged students. The RPM may be identifying students whose homes have provided experience with puzzles. . . it identifies more boys than girls, perhaps because it measures spatial ability."

The principal of a school with high African-American and Latino enrollments found the GATE teachers "extremely positive" about the changes. Nevertheless, one teacher at this school experienced extreme distress from working with "too many who didn't belong." The principal of the school with predominantly Latino enrollment "had no questions from teachers."

Interestingly, these principals reported different uses of the RPM. For example, the first principal quoted above has the RPM administered to all second- and fifth-grade students. In other schools, the RPM is administered only to those students nominated by school personnel and parents. The principal of a school with high enrollments of Latino and Indochinese students reported difficulty in assessing changes resulting from use of the RPM since identification of gifted students at this school "continues to rely on several versus one measure."

Based on the testing literature, project staff evaluate the RPM as a "far better measure of pure potential than tests such as the WISC-R, whose scores depend heavily on acquired knowledge" (Saccuzzo, 1993, p. 14). GATE staff suggest that "Teachers need to understand that they're getting excellent thinkers versus achievers."

Triumphs and Remaining Challenges

Triumphs

Despite the diversity of perspectives, this project clearly has had striking impact on students from groups traditionally underrepresented in programs for the gifted. Most significantly, the project resulted in immediate implementation of a new model for nomination and certification that in turn produced significant increases in the numbers and proportions of diverse students referred and enrolled in gifted programs. The project has produced additional data on nontraditional measures that may hold promise for identification of giftedness across ethnic groups.

Interviews provided insights regarding benefits not predicted by the proposal. As stated in the introduction, the senior GATE administrator attributes the retention of the district's GATE program to the project's development of a model that substantially increased access and provided strong theoretical and empirical justification. While not as dramatic, other benefits accrued that promise long-range impact. For example, project staff indicated that over thirty university students received direct experience in research related to improving the identification of gifted students from diverse ethnic and economic backgrounds. The project led to several graduate theses and dissertations that may stimulate further research in this area. The project has amassed a data base that includes more African-American, Latino, and Indochinese students than included in the standardization sample of the WISC-R. A principal reported that compared to the Wechsler, after which students "felt frustrated," taking the Raven "boosted students' self-esteem" irrespective of their performance on the measure. Project staff observed that, after nontraditional students are certified as gifted by the Raven, teachers often begin noticing these students' positive behaviors. The project is both "chipping away" at stereotypes regarding ethnicity and intelligence and giving access to bright students who otherwise would remain undiscovered and lost in the system.

Challenges

As with any worthy but time-limited enterprise, the project has produced challenges for researchers and practioners alike. Project staff point to a need to continue the search for a selection model that provides equal access to gifted programs for students from all ethnic, linguistic, and economic groups. They suggest that dynamic assessment ultimately may provide one alternative. Additionally, it would be interesting to follow the progress of nontraditional students identified for gifted programs to investigate long-term impact on these students. GATE staff perceive teacher and administrator inservice as a critical need to promote (a) understanding of the many manifestations of gifted potential and (b) strategies for accommodating gifted students who initially display heterogeneous achievement

levels. As one principal commented, "We need to change attitudes as the population demographics have changed; teachers' styles of teaching need to change. In addition, community and parent awareness programs will support broader understanding of assessment issues and student needs.

Conclusion

In less than three years, the project "Identifying Underrepresented Disadvantaged Gifted and Talented Children: A Multifaceted Approach" has directly affected the lives of over one thousand newly identified ethnically and linguistically diverse gifted students who otherwise would not have received special services. Moreover, the project's contribution to the institutionalization of a more equitable selection model in the nation's eighth largest school district will continue to impact subsequent cohorts of traditionally underrepresented gifted students as they enter the system. The results demonstrate the critical role played by federal funding of discretionary projects.

The project's success also attests to the importance of school-university collaboration in the generation and implementation of new knowledge. Rapid change occurred through the interaction of highly competent researchers and far-sighted GATE leaders who recognized the need for research-based practice and were willing to take risks to improve access. Both project and GATE staff predict that the results are generalizable to other large districts serving similarly diverse populations. In light of literature on multiple intelligences (e.g., Gardener, 1983) and the need to use multiple measures and avoid cutoff scores (e.g., Richert, 1991) especially when assessing diverse students, writers in the field will question the use of a single, standardized instrument for identification. Yet as the GATE administator suggested, "We welcome every urban school district to visit and review our program and would welcome an open debate of procedures used."

IDENTIFYING UNDERREPRESENTED DISADVANTAGED GIFTED AND TALENTED CHILDREN: A MULTIFACETED APPROACH

(Volume 2)

Dennis P. Saccuzzo, Nancy E. Johnson, & Tracey L. Guertin

San Diego State University

This research was funded by Grant R206A00569, U.S. Department of Education, Jacob Javits Gifted and Talented Discretionary Grant Program.

The authors express their appreciation to the San Diego Unified City Schools, to Gifted and Talented Education (GATE) Administrator David P. Hermanson, and to the following school psychologists: Will Boggess, Marcia Dijiosia, Eva Jarosz, Dimaris Michalek, Lorraine Rouse, Ben Sy, and Daniel Williams.

Correspondence should be addressed to Dennis P. Saccuzzo, Joint San Diego State/University of California, San Diego Doctoral Training Program, 6363 Alvarado Court, Suite 103, San Diego, California 92120-4913 (Telephone: 619-594-2844 / FAX: 619-594-6780 / e-mail: dsaccuzz@sunstroke.sdsu.edu).

© 1994
Do not reproduce in any form without express written permission from the authors.

CHAPTER 1

Use of the Raven Progressive Matrices Test in an Ethnically Diverse Gifted Population

Dennis P. Saccuzzo*

Nancy E. Johnson

Tracey L. Guertin

San Diego State University

This research was funded by Grant R206A00569, U.S. Department of Education, Jacob Javits Gifted and Talented Discretionary Grant Program.

The authors express their appreciation to the San Diego Unified City Schools, to Gifted and Talented Education (GATE) Administrator David P. Hermanson, and to the following school psychologists: Will Boggess, Marcia Dijiosia, Eva Jarosz, Dimaris Michalek, Lorraine Rouse, Ben Sy, and Daniel Williams.

Correspondence should be addressed to Dennis P. Saccuzzo, Joint San Diego State/University of California, San Diego Doctoral Training Program, 6363 Alvarado Court, Suite 103, San Diego, California 92120-4913 (Telephone: 619-594-2844 / FAX: 619-594-6780 / e-mail: dsaccuzz@sunstroke.sdsu.edu).

© Copyright 1994.
Do not reproduce in any form without express written permission from the authors.

Abstract

The efficacy of use of the Standard Raven Progressive Matrices Test (RPM) in the selection of gifted children from traditionally underrepresented groups was investigated in a large-scale study with a diverse population. A total of 16,985 Raven subjects included 22.7% Latinos, 37% Whites, 14% African-American, 2.8% Asian, 8.4% Filipinos, and 5.6% Indochinese, each of whom had been identified potentially gifted based on a case study analysis by a school psychologist. The resultant sample of children certified gifted based on Raven performance was compared with a group certified gifted based on individual administrations of the Wechsler Intelligence Scale for Children - Revised (WISC-R). The Raven gifted sample was also compared to actual enrollment ratios for the school district to ascertain if equity in representation could be achieved for gifted programs using the Raven. Although chi square results indicated that use of the RPM as opposed to the WISC-R led to increased equity for all groups, full equity was not achieved. When compared to the district population, the Raven-selected group showed underrepresentation for Latinos and African-Americans and overselection for Whites, Asians, and Filipinos. Chi square comparisons based on the expectation of equal gender representation revealed that the WISC-R disproportionately overselected boys, while the RPM showed no gender differences. The findings support the position that the RPM is a more equitable test than the WISC-R for ethnically diverse gifted populations and for girls.

Use of the Raven Progressive Matrices Test in an Ethnically Diverse Gifted Population

Professionals in the field of Gifted Education continue to express considerable interest in developing alternatives to traditionally used standardized tests in identifying gifted students. Such alternatives are particularly needed for students from traditionally underrepresented groups such as African-Americans and Latino/Hispanics. One such alternative, repeatedly mentioned in the literature, is the Raven Progressive Matrices (RPM) Test (Raven, 1958, 1960; Raven et al., 1986). A number of investigators have pointed to the RPM as a culturally reduced measure of cognitive ability with considerable promise as a measure of giftedness in traditionally underrepresented and culturally diverse students (Baska, 1986; James, 1984; Powers & Barkan, 1986; Powers, Barkan, & Jones, 1986).

The standard form of the RPM consists of 60 matrix problems, which are separated into five sets of 12 designs each. Within each set of 12, the problems become increasingly difficult, and each of the five sets is progressively more difficult. Each individual design has a missing piece. The student's task is to select the correct piece to complete the design from among six to eight alternatives. Correct responses are based on various organizing principles such as increasing size, reduced or increased complexity, and number of elements.

Because RPM stimuli are visually presented, it is easy to mistake the test as one of visual perception or spatial reasoning. It is neither. As Cherkes-Julkowski, Stolzenberg, and Segal (1990) have noted, "The Raven is as close to a study of pure thinking processes in the absence of the influence of specific content acquisition as is available" (p.7). As Snow and Colleagues have shown using radex and hierarchical models, the RPM is the best available measure of general intelligence (Marshalek, Lohman, & Snow, 1983; Snow, Kyllonen, & Marshalek, 1984). As a measure of general intelligence the RPM correlates highly with verbal measures of ability, even though the stimuli themselves are completely nonverbal (Carpenter, Just, & Shell, 1990). In fact, Positron Emission Tomography (PET) Scans, which produce computer generated images of the brain, have shown that the entire brain is involved in solving RPM problems, with the three most used areas being the right cerebral hemisphere, the left temporal lobes, and the left frontal lobes (Haier, Siegel, Nuechterlein, Hazlett, Wu, Paek, Browning, & Buchsbaum, 1988). The left temporal lobe involvement is most likely due to the use of verbal codes in solving RPM problems.

Because its stimuli are nonverbal, the RPM can be administered fairly in American schools to individuals who speak a language other than English. Because stimuli are visually presented, rather than spoken, they are not transitory. Thus, the stimulus remains in front of the student, which reduces the role of memory and even attentional factors in performance (Cherkes-Julkowski et al., 1990). Solving RPM problems does not depend heavily, as do all language based tests, on acquired knowledge, specific cultural experiences, or reading ability. As Carpenter et al. (1990) have noted, "The Raven measures the ability to reason and solve problems involving new information, without relying extensively on an explicit base of declarative knowledge derived either from schooling or previous experience." In sum, the Raven measures general intelligence and correlates with measures of linguistic ability. It uses nonverbal stimuli and does not require a specific knowledge base.

Previous investigations have found that the Raven has not only been effective in identifying traditionally underrepresented children for gifted programs, but also correlates with their success (Baska, 1986). In one study, Powers, Barkan, and Jones (1986) found no significant differences between Hispanic and Anglo-American children's mean scores, score variability, and test reliability for the RPM. Other studies have supported the validity of the RPM for Hispanic (Powers & Barkan, 1986) and Navajo students (Sidles & MacAvoy, 1987).

As Raven (1989) has noted, the Raven Progressive Matrices Tests have been used in over 1,600 published psychological studies (see Court, 1988; Court & Raven, 1977, 1982), making the RPM among the most researched psychological tests. Until recently, however, the RPM has not been used widely in applied clinical and educational settings. A major problem had been the lack of adequate U. S. norms (Kaplan & Saccuzzo, 1989, 1993). An extensive and relatively current set of norms, which include U. S. as well as worldwide norms, is now available (Raven, Summers et al., 1986). More than 30,000 students

aged 5 to 18 were chosen to be representative of school districts across the United States in approximately 30 norming studies. Ethnicity and socioeconomic factors made independent contributions to the variance. Ethnic differences, which were attributed to differences in birth weight, infant mortality, and the incidence of serious childhood illness, showed a decline compared to earlier reports (Burciaga, 1973; Hoffman, 1983; Jensen, 1980). There were, for example, no major Hispanic/White differences in the Ontario-Montclair School District of California. Moreover, the RPM was found to have equal predictive validity within each group (Hoffman 1983, 1986).

It should be noted that while ethnic differences may be declining, there remain differences in the mean scores as a function of ethnicity as well as socioeconomic background. Nevertheless, the question remains as to whether the RPM can be used to achieve a more equitable selection of students than can be obtained with more widely used traditional tests, such as the Wechsler Intelligence Scales.

In the present study we present the results of a Jacob Javits grant whose purpose was to evaluate the efficacy of the RPM in the selection of traditionally underrepresented groups for gifted programs. The data were collected over a three year period and include an archival data pool of over 5,000 administrations of the Wechsler Intelligence Scale to children from 8 major ethnic backgrounds.

Method

Subjects:

The subjects were 16,985 children who were referred and evaluated for the gifted program at San Diego City schools between the Fall of 1991 and the Spring of 1993. Students were classified into one of eight ethnic backgrounds based on self-report of the parent as follows: 3,864 Latino/Hispanic, 6,286 White, 2,389 African-American, 483 Asian, 75 Native-American, 104 Pacific Islander, 1,419 Filipino, and 958 Indochinese. There were 1407 classified as "Other". Of the 16,985 subjects, 51.5% (8,740) were female, 48.5% (8,245) male. The distribution by grade level was as follows: 24 first-, 7,664 second-, 1,467 third-, 819 fourth-, 3,737 fifth-, 748 sixth-, 2,122 seventh-, 263 eighth-, and 90 ninth-graders. There were 51 cases where data on grade was missing.

As a comparison sample, the files of all children evaluated for giftedness in the San Diego City School System between 1984 and 1990 were examined. During this time period, the district had used the WISC-R as the primary tool for identifying giftedness. A total of 9315 students had been given the WISC-R during this time period.

A second point of comparison was based on actual enrollment figures by ethnic background during the course of the study. The average enrollment ratio in the district as a whole by ethnic background between 1991 and 1993 was as follows: 27.2% Latino/Hispanic, 37.2% White, 16.2% African-American, 2.3% Asian, 0.6% Native-American, 0.7% Pacific Islander, 8% Filipino, and 7.7% Indochinese.

Procedure:

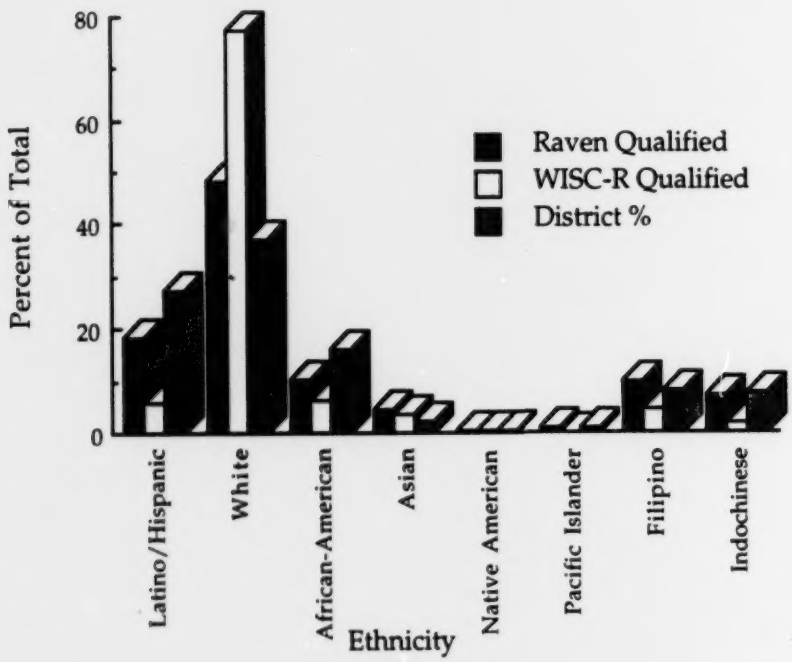
Children were given either a WISC-R (entire 1984-1990 sample) or a Standard Raven (entire 1990-1993 sample) by a district school psychologist. The WISC-Rs were individually administered; the Raven was group administered. As a part of the evaluation process the school psychologists conducted a case study analysis of each child to evaluate for the presence of risk factors and level of achievement (see Saccuzzo, Johnson, & Russell, 1992). Five risk factors were considered. These were: cultural/language, economic, emotional, environmental, and health. Achievement was evaluated in terms of standard scores on the California Test of Basic Skills (CTBS) or the Abbreviated Stanford Achievement Test (ASAT).

Children were certified as gifted if they obtained a Full Scale IQ of 130 on the WISC-R or an IQ equivalent of 130 on the Raven (i.e., achieved a score in at least the 98th percentile) based on the Smoothed U.S. Norms reported by Raven et al. (1986). In addition, children who had two or more of the risk factors were certified as gifted if they had a Full Scale WISC-R IQ of 120 or Raven IQ equivalent of 120. Finally, children who obtained a WISC-R or Raven score of 3 standard deviations above the mean were placed in a special "Seminar" program.

Results

Figure 1 illustrates the ethnic composition of the district for all eight ethnic backgrounds compared to all children who were certified as gifted with the WISC-R (entire 1984-1990 sample) and to all children who were certified as gifted with the Raven (entire 1990-1993 sample). Inspection of Figure 1 reveals that the RPM led to increased equity for all ethnic groups. For example, only about 20% of the expected number of Latino/Hispanic were selected with the WISC-R, while about 80% of the expected were selected using the RPM. For the Whites, about 200% of the expected were selected with the WISC-R, while only about 120% of the expected were selected with the RPM. Pacific Islanders, Native-Americans, and Indochinese were all greatly underselected by the WISC-R, but selected according to the expectation based on their numbers with the Raven. Filipinos went from about 60% of expectation with the WISC-R to about 120% with the Raven. African-Americans went from about 40% of the expectation to over 60%. Thus, the RPM provided a more equitable distribution for all ethnic backgrounds.

Figure 1. Ethnic composition of those certified gifted on the basis of WISC-R scores (1984-1990) versus Raven's Progressive Matrices scores (1990-1993).



To demonstrate statistically the superiority of the RPM over the WISC-R in terms of equity, we used the following procedure. Chi Squares were computed for each ethnic group using the number of children certified by use of the WISC-R in each ethnic background as the expected and the number of children in that ethnic background selected by use of the Raven as the observed. Table 1 provides a summary of the findings. As Table 1 shows, there were significant differences in the direction of increased equity for all groups but Native-Americans (where the *n* was small) and Asians.

Table 1. *Chi Square results using children certified with the WISC-R as the expected and children certified with the Raven as the observed*

Ethnicity	*df*	*n* (Expected)	*n* (Observed)	Chi Square
Latino/Hispanic	1	413	1304	1922.23***
White	1	5535	3441	792.20***
African-American	1	454	714	148.90***
Asian	1	260	306	8.14
Native American	1	20	36	12.80
Pacific Islander	1	10	50	160.00***
Filipino	1	321	713	478.70***
Indochinese	1	112	513	1435.72***

* $p < .05$
** $p < .01$
*** $p < .001$

Despite the substantial improvement in equity when the RPM was used, inspection of Figure 1 indicates that full equity was not achieved. To verify this observation statistically, Chi Squares were again computed using the proportionate number of children in each ethnic background as the expected compared to the number actually certified with the Raven as the observed.

Table 2 presents a summary of these findings and reveals significant discrepancies for all groups except Native-Americans, Pacific Islanders, and Indochinese. Latino/Hispanics and African-Americans were significantly underselected compared to the expectation while Whites, Asians, and Filipinos were significantly overselected.

Table 2. *Chi Square results comparing the actual proportion of children in each ethnic background with the number actually certified with the Raven*

Ethnicity	*df*	*n* (Expected)	*n* (Observed)	Chi Square
Latino/Hispanic	1	2009	1351	215.51***
White	1	2743	3568	244.69***
African-American	1	1200	766	156.96***
Asian	1	170	319	130.59***
Native American	1	41	39	0.10
Pacific Islander	1	55	48	0.89
Filipino	1	595	739	34.85***
Indochinese	1	569	532	2.41

* $p < .05$
** $p < .01$
*** $p < .001$

To examine possible ethnic differences on the Raven independently of risk factors, we used the following system. First, we considered only those children who scored in the 98th percentile or better on the Raven. Next, we determined the number of children in the school district in each ethnic background that would represent 2 percent of that group. For example, given the total number of Latino/Hispanics in the district, 905 would be in the top two percent. The actual number of children in the top two percent for each ethnic background was used as the expected, while the number of children in each background who actually scored in the upper 2% (i.e., 98th percentile or better) was used as the observed in a series of Chi Square analyses. Table 3 summarizes these analyses and shows significant discrepancies for four groups: Latino/Hispanics and African-Americans, who were underselected; and Whites and Asians who were overselected compared to the expectation.

Table 3. *Chi Square results comparing the actual number of children in the top 2% of each ethnic background with the number who actually scored in the upper 2%*

Ethnicity	*df*	*n* (Expected)	*n* (Observed)	Chi Square
Latino/Hispanics	1	905	379	305.72***
Whites	1	1238	2009	480.16***
African-Americans	1	541	209	203.74***
Asians	1	77	173	119.69***
Native Americans	1	18	21	0.50
Pacific Islanders	1	25	12	6.76
Filipinos	1	268	316	8.59
Indochinese	1	256	199	12.69

* $p < .05$
** $p < .01$
*** $p < .001$

To investigate the possibility of gender differences in WISC-R and Raven performance, the number of boys and girls who actually scored in the 98th percentile and above on each test in each ethnic group was compared to the expectation that there would be equal numbers of boys and girls. As can be seen in Table 4, there were no significant differences in performance for boys and girls of any ethnic background on the Raven.

Table 4. *Chi Square results comparing the number of boys and girls of each ethnic background who actually scored in the top two percent on the Raven*

Ethnicity	*df*	Total *n*	Boys (Observed)	Chi Square
Latino/Hispanics	1	374	181	0.19
Whites	1	2002	1057	3.13
African-Americans	1	206	116	1.64
Asians	1	172	79	0.57
Native Americans	1	21	12	0.21
Pacific Islanders	1	12	6	0
Filipinos	1	315	170	0.99
Indochinese	1	198	100	0.01

* $p < .05$
** $p < .01$
*** $p < .001$

For the WISC-R, by contrast, significantly more White boys (2632) than girls (2272) achieved an IQ score in the top two percent (Table 5). Moreover, the trend was in favor of boys on the WISC-R for every ethnic group except Pacific Islanders.

Table 5. *Chi Square results comparing the number of boys and girls of each ethnic background who actually scored in the top two percent on the WISC-R*

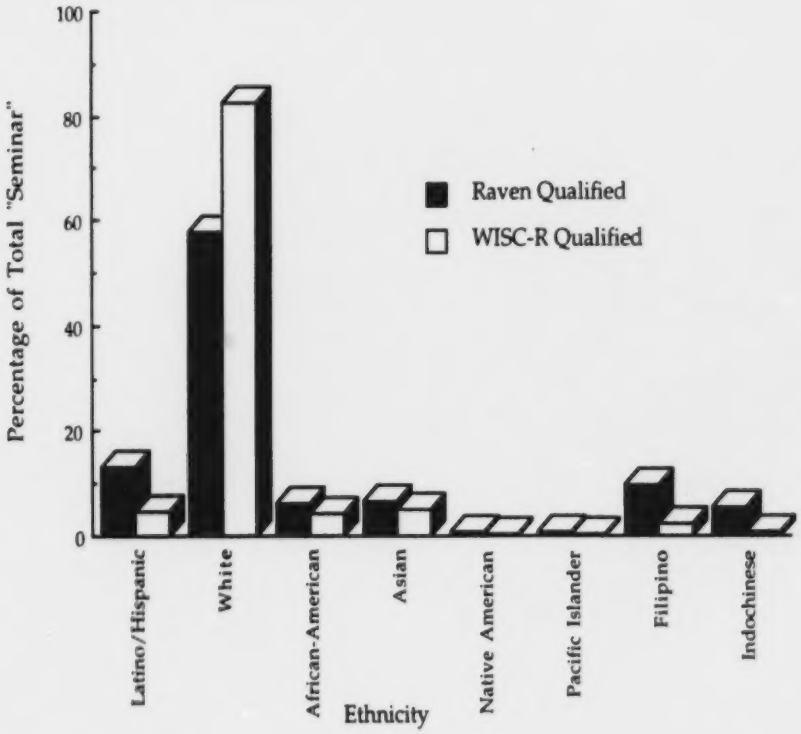
Ethnicity	*df*	*n*	Boys (Observed)	Chi Square
Latino/Hispanic	1	265	152	2.87
White	1	4904	2630	13.21***
African-American	1	252	129	0.07
Asian	1	202	109	0.63
Native American	1	13	9	0.96
Pacific Islander	1	9	3	0.50
Filipino	1	182	107	2.81
Indochinese	1	61	34	0.40

* $p < .05$
** $p < .01$
*** $p < .001$

In order to examine performance of individuals at the highest level of ability (i.e., three standard deviations above the mean), it was necessary to generate local norms, since the norms provided in the manual only go up to the 99th percentile. In constructing local norms for the 99.1 through 99.9 percentile, we used the following procedure. Based on the table of smoothed North American norms provided by Raven, et al. (1986), we selected all those children in our study who had obtained a raw score in the 99th percentile for each age range in the table. We then examined the frequency distribution of raw scores for each age range and attempted to break the scores down into ten groups occurring with equal frequency, representing the 99.0 through 99.9 percentile.

In the analyses that followed, the local norms (Guertin, Johnson, Saccuzzo, & Lopez, 1992) were used to identify students who scored three standard deviations above the mean (i.e., above the 99.87 percentile). Figure 2 illustrates the proportion of students from the entire 1990-1993 sample, by ethnic background, who obtained scores at the 99.9 percentile on the local Raven norms versus the proportion, by ethnic background, who obtained WISC-R Full Scale IQ's of 145 or above. As inspection of Figure 2 shows, there was an increase in the representation of children selected for the schools' very gifted "Seminar" program for all ethnic backgrounds except for the Whites, who represent about 35 percent of the district. With the WISC-R, Whites represented more than 80% of the children selected for the "Seminar" program. With the Raven, Whites represented less than 60%.

Figure 2. Ethnic composition of the 99.9th percentile: WISC-R versus Raven's Standard Progressive Matrices



To demonstrate statistically the superiority of the RPM over the WISC-R for selection at the highest level of ability, Chi Square analyses were computed for each ethnic background using the proportionate number of children selected by the WISC-R as the expected and the number selected by the Raven as the observed, as was done in Table 1. Results were similar to those found for the children who scored above 130. In fact, there were significant increases in the direction of increased equity for all ethnic backgrounds except Asians and Native Americans (See Table 6).

Table 6. *Chi Square results using children certified "Seminar" with the WISC-R as the expected and children certified "Seminar" with the Raven as the observed*

Ethnicity	*df*	*n* (Expected)	*n* (observed)	Chi Square
Latino/Hispanics	1	24	69	84.38***
Whites	1	430	300	38.79***
African-Americans	1	22	33	5.50*
Asians	1	26	33	1.88
Native Americans	1	1.4	3	1.83
Pacific Islanders	1	1	4	9.00**
Filipinos	1	13	49	99.69***
Indochinese	1	4	29	156.25***

* $p < .05$
** $p < .01$
*** $p < .001$

As with the children who scored two standard deviations above the mean, there were inequities for children who scored three standard deviations above the mean. A total of 520 children in our sample scored in the 99.9th percentile on the Raven, as determined by local norms. We compared the number who actually scored at that level with the number expected based on district proportion for each ethnic group. Results, summarized in Table 7, indicate that Latino/Hispanics and African-Americans were underrepresented while Whites, Asians, and Indochinese were overrepresented.

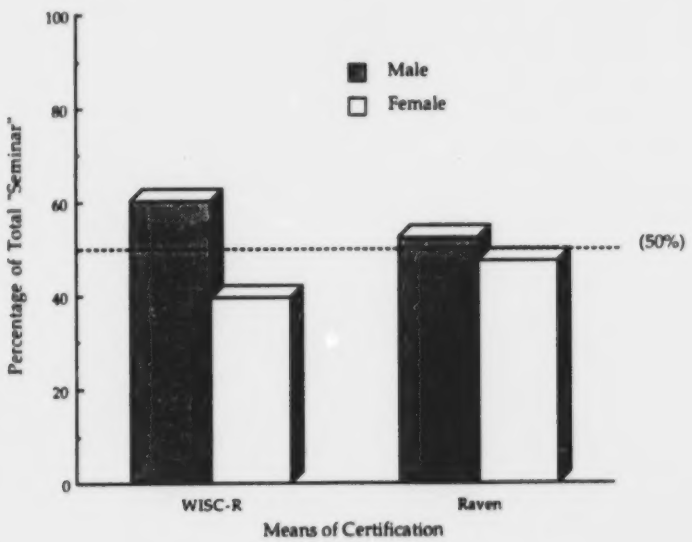
Table 7. *Chi Square results comparing children certified "Seminar" using the Raven to their proportionate numbers in the district*

Ethnicity	*df*	*n* (Expected)	*n* (Observed)	Chi Square
Latino/Hispanics	1	141	69	36.77***
Whites	1	193	300	59.32***
African-Americans	1	84	33	30.96***
Asians	1	12	33	36.75***
Native Americans	1	3	3	0.00
Pacific Islanders	1	4	4	0.00
Filipinos	1	42	49	1.17
Indochinese	1	41	29	3.51

* $p < .05$
** $p < .01$
*** $p < .001$

Figure 3 illustrates the gender composition for children who scored either at or above the 99.9 percentile on the Raven or had a Full Scale WISC-R IQ of 145 or greater.

Figure 3. Gender composition of the 99.9th percentile: WISC-R versus Raven's Standard Progressive Matrices



As Figure 3 shows, the substantial gender imbalance in favor of males with the WISC-R was essentially eliminated with the RPM. Chi square analyses statistically demonstrated the reduction in gender bias at the highest levels of ability. Results are summarized in Tables 8 and 9, where actual numbers of boys and girls who scored three standard deviations above the mean on the WISC-R and the Raven, respectively, were compared with the expectation of equal numbers of boys and girls.

Table 8. *Chi Square results comparing boys and girls certified "Seminar" using the WISC-R with the expectation of equal gender numbers*

Ethnicity	*df*	Total *n*	Boys (Observed)	Chi Square
Latino/Hispanic	1	52	29	0.35
White	1	925	570	22.47***
African-American	1	47	26	0.27
Asian	1	56	30	0.14
Native American	1	3	2	0.17
Pacific Islander	1	2	2	1.00
Filipino	1	29	21	2.91
Indochinese	1	8	5	0.25

* $p < .05$
** $p < .01$
*** $p < .001$

Table 9. *Chi Square results comparing boys and girls certified "Seminar" using the Raven with the expectation of equal gender numbers*

Ethnicity	*df*	*n* (total)	Boys (Observed)	Chi Square
Latino/Hispanic	1	69	34	0.007
White	1	300	156	0.24
African-American	1	33	18	0.14
Asian	1	33	15	0.14
Native American	1	3	1	1.16
Pacific slander	1	4	3	0.5
Filipino	1	32	32	2.30
Indochinese	1	29	15	0.02

* $p < .05$
** $p < .01$
*** $p < .001$

The efficacy of the Raven was compared to that of the WISC-R for predicting achievement in a series of correlations between intelligence tests and achievement tests used by the school district. Each child received a test of intelligence and an achievement test during the same school year. Table 10 demonstrates correlations between performance on the Raven, as expressed in z-scores, and on the subtests of the Comprehensive Test of Basic Skills (CTBS) for 1707 children, as well as correlations between CTBS and WISC-R for another 1925. As can be seen, the Raven correlated more highly with CTBS Total Language subscores than did the WISC-R for African-American and White children, but not for Latinos. In fact, for African-Americans no significant correlations were found between WISC-R scores and CTBS Total Language. Raven performance correlated more highly with CTBS Total Math scores than did WISC-R only for White children. For all three ethnic backgrounds, WISC-R VIQ scores were more highly correlated with CTBS Total Reading scores than were Raven scores.

Table 10. *Correlation(r) of Raven or WISC-R performance with achievement test (CTBS) performance for children of three ethnic backgrounds*

		Subtest		
		CTBSTL	CTBSTR	CTBSTM
Whites				
RAVEN	(n = 901)	.1907**	.1727**	.2187*
VIQ	(n = 1566)	.1638**	.2479**	.1836**
PIQ	(n = 1566)	.1081**	.1274**	.1648**
FSIQ	(n = 1566)	.1623**	.2292**	.2069**
African-Americans				
RAVEN	(n = 276)	.2372**	.1916**	.1257*
VIQ	(n = 221)	.0691	.2740**	.1440
PIQ	(n = 221)	.0184	.1126	.1771**
FSIQ	(n = 221)	.0541	.2406**	.2002**
Latinos/Hispanics				
RAVEN	(n = 530)	.1563**	.0797*	.1327**
VIQ	(n = 138)	.1899*	.1365	.3150**
PIQ	(n = 138)	-.0476	-.0196	.1708*
FSIQ	(n = 138)	.0761	.0725	.2718**

* $p < .05$
** $p < .01$

Correlations between the Raven and the Abbreviated Stanford Achievement Test (ASAT) for children of six ethnic backgrounds are summarized in Table 11. Correlation coefficients ranged from .2235 to .3109, with a median $r = .25$. Clearly, the Raven correlates more highly with the ASAT than with the CTBS in all three domains measured (language, reading, and math). In addition, Raven—ASAT correlations were higher than WISC-R—CTBS correlations.

Table 11. *Correlation (r) of Raven performance with achievement as measured by the Abbreviated Stanford Achievement Test for children of six ethnic backgrounds (Raven performance was expressed in Z scores.)*

Ethnicity	*n*	Total Language	Total Reading	Total Math
African-American	1581	.2478**	.2639**	.2695**
Asian	305	.2386**	.2654**	.2634**
White	4020	.2245**	.2252**	.2494**
Filipino	1002	.2235**	.2438**	.2429**
Indochinese	587	.2582**	.2484**	.2584**
Latino	2528	.2468**	.2981**	.3109**

** $p < .01$

Discussion

Our results lead to two clear conclusions. First, considering only children referred for giftedness testing, the RPM produces far better equity for all ethnic backgrounds when compared to the WISC-R. While the RPM overselected Whites, it did so at a substantially reduced rate (i.e., 120 percent over expectation with the Raven vs. 200 percent over expectation with the WISC-R). Moreover, while it did not produce complete equity, even when considering such risk factors as low socioeconomic or cultural differences, the RPM led to substantially increased selection ratios for traditionally underrepresented groups such as Latino/Hispanics and African-Americans. Moreover, the RPM did lead to an equitable selection for Native-Americans, Pacific Islanders, and Indochinese, all of whom had been underrepresented with the WISC-R.

The success of the RPM with Indochinese is of interest in terms of evaluating non-English speaking children. In the past the district had difficulties evaluating giftedness in Indochinese children who spoke little or no English. Since use of the RPM enabled evaluation of ability independently of language, it was possible to assess these children with the least bias heretofore achieved. With the RPM Indochinese were selected almost exactly in proportion to their numbers in the district as a whole.

The advantage of the RPM was not only evident in terms of producing a more equitable distribution, but it was more effective than the WISC-R in predicting language achievement for African-American and White children, as well as in predicting math achievement for Whites. Although our data cannot be used to directly compare the WISC-R with the Raven for predicting scores on the ASAT, RPM scores were more highly correlated with ASAT scores than with CTBS scores for all groups. However, the WISC-R correlated more highly than the RPM with CTBS Total Reading for all groups and with Total Math for African-Americans and Latinos. It would be instructive to directly compare WISC-R — ASAT and Raven — ASAT correlations in the same sample to more completely compare efficacy for predicting achievement.

The Raven's ability to predict achievement, even language achievement, is due to its high correlation with Spearman's (1904, 1927a, 1927b) *g* factor (see Carpenter et al., 1990; Marshalek et al., 1983; Snow et al., 1984). Since tests of language achievement are highly correlated with *g*, *g*-saturated tests such as the RPM share common variance with them. Thus, the RPM can have clear advantages for measuring abilities for individuals who speak a language other than English or are from a different

culture (Court, 1991). Moreover, since it does not depend on an explicit knowledge base, as does the WISC-R and other verbally weighted standardized tests, the RPM is better suited to traditionally underrepresented children. It must be emphasized, however, that the RPM is not simply for underrepresented children, as it led to a more equitable distribution across ethnicity, even for Whites.

Previous studies that have compared the WISC-R and the Raven in the selection of gifted children (e.g., James, 1984; Pearce, 1983; Tulkin & Newbrough, 1968; Meeker, 1973; Kier, 1949) have been primarily concerned with the correlation between the two measures. Such studies have reported correlations in the .70's and have been generally supportive of the Raven as an alternative. Our findings suggest that where equity is a concern, the Raven is a far better measure.

It should be noted, however, that the population of gifted children selected by the Raven is not identical to that selected by the WISC-R. The differences are important. First, there is the group of children who would be selected by either test. These children tend to be verbally advanced, highly intelligent, and high in achievement. Second, there is the group of children who would be qualified by a WISC-R, but not by a Raven. In our experience, such children tend to be verbally advanced and highly motivated. Teachers of academic gifted programs readily accept these children as gifted, especially in the early years. Due to the unreliability of IQ scores at the upper IQ levels, especially for the younger age levels, the IQ's of many of these verbally advanced children show regression to the mean as they mature.

A third group of children are those who would not qualify with the WISC-R, but would with the Raven. Such children are of extremely high potential, but may be only average (or even below average) in achievement. Others may be of very high ability, but poorly motivated. Our experience has revealed that this type of student is not always accepted by teachers as gifted. Yet, it is this very type of child — the one with raw, undeveloped potential — for whom the present investigation was aimed. For programs using the Raven on a widescale basis, teacher training is often needed to help integrate these students into the gifted classroom.

One of the reasons tests like the WISC-R continue to be used, in spite of their obvious selection bias, is that they are reliable and objective. To date, no other approach matches standardized tests in terms of reliability, predictive validity, and objectivity. Yet, given the huge selection bias inherent in the WISC-R, it is difficult to imagine how it, and others like it, can continue to be used in today's litigious environment and heightened awareness of civil rights. A simple examination of Figure 1 would find the WISC-R completely unacceptable as a tool to select for giftedness.

The Raven clearly fared better in terms of equity without sacrificing objectivity, reliability, and predictive validity. Nevertheless, it is also clear that the Raven, even when used in conjunction with a consideration of risk factors, still falls short of producing equity across all ethnic groups.

Based on our present findings, and on previous reviews of psychometric tests (Kaplan & Saccuzzo, 1993), we are convinced that as traditional tests are presently used, there exists not a single one that would produce an equitable selection for gifted programs. If the goal is to select children for an academic program using an objective, reliable measure with high predictive validity, then traditional tests, as they are presently used, fall short in terms of equity. The search for multiple intelligences, as suggested by Gardner (1983), is, of course, one viable option. The use of portfolios and other subjective approaches, however, while promising on a small scale, faces numerous obstacles in terms of objectivity, reliability, and predictive validity.

The question remains, are traditional tests beyond redemption? We believe that there remain potentially promising options. One such option, suggested by Raven (1989), is the use of local ethnic norms for selection purposes in gifted programs. A second, suggested by Carlson (1989) and Colleagues (Carlson & Dillon, 1978; Carlson & Wiedl, 1978), is to use traditional tests in creative ways. For example, using a dynamic testing approach with the Raven, Carlson and Wiedl (1979) were able to eliminate Hispanic/White and Black/White differences in IQ. Before we abandon what remains the most objective, reliable, and valid approach to selection, it behooves us to determine whether innovative uses can rescue traditional assessment procedures, or if they should be abandoned in favor of less psychometrically sound, but perhaps more equitable, approaches.

CHAPTER 2

Use of the WISC-R with Disadvantaged Gifted Children: Current Practice, Limitations, and Ethical Concerns

Nancy E. Johnson
San Diego State University/University of California San Diego
Joint Doctoral Program in Clinical Psychology

This research was funded in part by Grant R206A00569, U.S. Department of Education, Jacob Javits Gifted and Talented Discretionary Grant Program.

The author expresses appreciation to her mentor, Dennis P. Saccuzzo, San Diego State University, to the San Diego Unified City Schools, to Gifted and Talented Education (GATE) Administrator David P. Hermanson, and to the following school psychologists: Will Boggess, Marcia Dijiosia, Eva Jarosz, Dimaris Michalek, Lorraine Rouse, Ben Sy, and Daniel Williams.

Correspondence should be addressed to Nancy E. Johnson, San Diego State University, 6363 Alvarado Court, Suite 103, San Diego, California 92120-4913 (Telephone: 619-594-2845 /FAX: 619-594-6780 / e-mail: njohnson@psychology.sdsu.edu).

Copyright 1992
by
Nancy Ellen Johnson

ABSTRACT

The Wechsler Intelligence Scale for Children-Revised (WISC-R) is the most widely used individual instrument for inclusion or exclusion of children into programs for the gifted in the United States. The present study investigated the psychometric adequacy of this use of the WISC–R in a population of 8396 potentially gifted elementary grade children of diverse ethnic and cultural backgrounds as well as diverse emotional and social environments. Study I included analyses of VIQ-PIQ base rates in 5796 children who achieved Full Scale IQ (FSIQ) scores of 130 or above, plus comparisons of similarities and differences in subsamples divided on ethnic background, on level of risk identified in the child's home environment, and on the extremes of achievement (measured by a standardized achievement test). In contrast to findings from the WISC-R standardization sample, children in this study differed strikingly, across ethnic groups and across levels of risk, in shape of the VIQ-PIQ difference distribution but not in absolute size of the VIQ-PIQ difference. The frequency distributions for African-Americans and Caucasians were skewed in favor of VIQ; for Filipinos, in favor of PIQ. Those of Asians and Hispanics closely resembled normal distributions. Skewness for children with identified risk was in favor of PIQ relative to those without risk. The importance of clinical versus statistical significance in decision-making was discussed, with particular attention to what constitutes a 'rare' VIQ-PIQ difference in gifted children. Study II attempted, through multivariate modeling, to identify either a single model or individual models, using subtests of the WISC-R, that would select equally accurately from five ethnic groups (African-American, Asian, Caucasian, Filipino, and Hispanic). No single model or combination of individual models was found to select equally from each of the ethnic backgrounds in a proportionately balanced random subsample of 1438. Implications for this use of the WISC-R in diverse gifted populations whose characteristics differ from those of the standardization sample were discussed, in light of the professional ethics of responsible test use.

I. Introduction

Currently, identification of giftedness in school age children is undertaken nationwide with the aim of providing special educational services for those with special gifts and talents. Historically, the use of tests to identify individuals with special talent has been recorded as early as 2200 BC in China (DuBois, 1970). In 1869 Galton first addressed the concept of genius in the psychological literature. In 1925 Terman began the first major study in which giftedness was operationally defined in terms of performance on standardized IQ tests. Since these landmark contributions, conflict and controversy have abounded in the educational and psychological literature on giftedness. Disagreements continue over the definition of giftedness per se, its measurement by the use of IQ and achievement tests, and its nurturance by special instructional programs. This work will focus on one aspect of giftedness: ethical use of tests in the selection of children from diverse backgrounds for early inclusion in special programs for the gifted and talented.

Identification and inclusion of gifted children from varied cultural and linguistic backgrounds into gifted and talented programs at an early age is vital. As Horowitz and O'Brien (1986) note, "there is no way to measure the loss when individuals capable of functioning considerably above the normal level do not contribute as much to society as their capabilities will allow" (p. 1147). The summary of findings in an evaluation of the Gifted and Talented Education (GATE) program in San Diego in the academic year 1989-1990 (Millett, 1990) included the information that "GATE students outperformed gifted students who are not participating in the program at every grade level" (p. 9). Given the demonstrated benefits of programs for gifted children, educators face the challenge of early identification of children with the highest potential for inclusion in enrichment programs. This problem becomes more critical in light of mandates that educational programs strive to guarantee equal access and yet operate within a framework of increasingly restrictive educational budgets.

Problems in the Definition of Giftedness

Currently in this country most efforts to identify giftedness in children utilize a definition based on intelligence, measured by some form of standardized group or individual IQ test. The trend began to be formalized in 1971, when the first definition of gifted and talented children was proposed on a national level (Pub. L. 91-230, § 806):

> Gifted and talented children are those identified by professionally qualified persons who by virtue of outstanding abilities, are capable of high performance. These are children who require differentiated educational programs and/or services beyond those normally provided by the regular school programs in order to realize their contribution to self and society.
>
> Children capable of high performance include those with demonstrated achievement and/or potential ability in any of the following areas, singly or in combinations: (1) general intellectual ability, (2) specific academic aptitude, (3) creative or productive thinking, (4) leadership ability, (5) visual and performing arts, (6) psychomotor ability.

Seven years later, 42 states had either enacted laws or formulated guidelines for the definition of giftedness. In all 42 states, including California and New York, general intellectual ability was specified (Fox, 1981).

The issue of the definition of the nature of "intelligence," thought to underlie intellectual ability and academic performance, has probably been debated as much as any other in the history of the psychological literature. Binet (in Terman, 1916) defined intelligence as "the capacity to make adaptations for the purpose of attaining a desired end" (p. 45). Spearman (1923) wrote that intellect involves "educing either relations or correlates" (p. 300), and proposed a two-factor theory; *g* was defined as an underlying general mental energy, whereas *s* represented one or more specific factors. Wechsler (1958) espoused the definition: "the aggregate or global capacity of the individual to act purposefully, to think rationally, and to deal effectively with his environment" (p. 7). However, Thorndike (1927) theorized that intelligence involves interconnected but distinct abilities and so advocated a multifactor approach.

Guilford (1967) developed a multifactor theory of intelligence based on three dimensions—the operations involved in information processing, the contents, and the products. In contrast, Vernon's (1950) was a hierarchical theory of intelligence based on the hypothesis that *g* is at the highest level of the hierarchy and represents the broadest aspect.

More recently, Sternberg (1986) developed a theory that divides intelligence into three dimensions. Gardner (1983), on the other hand, suggested that there are several distinct and relatively separate competencies, which he described as multiple intelligences. The debate continues, with some theorists espousing models based on an underlying basic mental capacity and others favoring a set of distinct and relatively discrete mental abilities.

Issues in the Assessment of Intellectual Giftedness

In acknowledging that there are many definitions of what constitutes intelligence, we must also acknowledge that there are many tests that purport to measure it. At the present time, however, the single instrument most frequently used for identification of giftedness in children in the United States is the Wechsler Intelligence Scale for Children - Revised (WISC-R) (Klausmeier, Mishra, & Maker, 1987). The WISC-R has been widely acknowledged to have excellent reliability and concurrent validity (Sattler, 1988). The current study examined the characteristics, efficacy, and fairness of this particular use of the WISC-R in one large school district (San Diego City Schools) over a seven-year span of time.

The San Diego City School District is among the most culturally diverse in the nation. The 1991-92 student population of 123,503 included 35.4% Caucasian, 28.8% Hispanic, 16.3% African American, and 8.1% Filipino children. The remaining 11.4% consisted of Indochinese, Asian, Pacific Islander, and Native American students. Programs for gifted and talented students, begun in the district in the 1940's, have demonstrated an on-going commitment to achieving equal access for individuals of all ethnic backgrounds through the use of selection instruments more likely to identify giftedness in culturally and linguistically different students. Despite these attempts, the non-Caucasian student population in gifted programs was 36.3% in 1989-90, as opposed to 61% in the school district as a whole. Underrepresented groups included Hispanics and African Americans; overrepresented were Asian, Filipino, and non-Hispanic white students (Millett, 1990). Richert (1987) cited figures published by the U.S. Department of Education's Office of Civil Rights revealing that groups such as Hispanics and African-Americans are underrepresented by as much as 70% in gifted programs throughout this nation. Thus the underselection of these two groups in San Diego reflects a nationwide problem. The National Report on Identification for Gifted and Talented Youth (Richert, Alvino, & McDonnel, 1982) noted problems with traditional selection procedures. Indeed, today most authorities believe that especially for disadvantaged groups traditional standardized tests should not be the sole or even the primary measure of giftedness (Fox, 1981; Garcia, 1981; Horowitz & O'Brien, 1986; McKenzie, 1986; Meeker & Meeker, 1973; Renzulli, 1978; Sternberg, 1981).

The American Educational Research Association, The American Psychological Association, and the National Council on Measurement in Education take the position that "In elementary or secondary education, a decision or characterization that will have a major impact on a test taker should not automatically be made on the basis of a single test score." (Standard 8.2, Standards for Educational and Psychological Testing, 1985). Although many authorities do recommend the use of multiple identification procedures such as IQ, achievement, and behavioral data in the identification of giftedness, in practice much emphasis is commonly placed on a single measure of achievement or of overall intelligence (Alvino, McDonnel, & Richert, 1981). Zigler and Farber (1985) stated that a specific defined level of IQ (such as a score two standard deviations above the mean) is the most adequate index of giftedness. Pegnato and Birch (1959), Clark (1979), and Hagen (1980) recommended use of an individually administered IQ test as the best and the quickest way to find most gifted children. Sattler (1988) concluded that "the single best method available for the identification of children with superior cognitive abilities is a standardized, individually administered test of intelligence..." (p. 671), but went on to note that among those who are difficult to identify as gifted are children who are culturally different, especially since they may not show superior oral language skills. Indeed, as was so well expressed by the Standards for Educational and Psychological Testing (1985), "A child from one culture

who is evaluated with morés appropriate to another culture may be considered taciturn, withdrawn, or of low mental ability."

Methodological Issues in WISC-R Testing of Ethnic Groups

Use of standardized intelligence test summary scores without ethnic, cultural, gender, economic, and other considerations is based on a uniformity assumption: that all students, all testers, and all situations are homogeneous. The fallacies inherent in this assumption in the use of standardized tests have been repeatedly noted (Guertin, Ladd, Frank, Rabin, & Hiesler, 1971; Lewandowski & Saccuzzo, 1976). Unfortunately, most standardized tests have only a single set of norms that have not been corrected for the demographic characteristics of the individual. The WISC-R, for example, yields scores corrected only for chronologic age. It has long been recognized that the influence of demographic variables in tests of brain function is apparent for individuals (Finlayson, Johnson, & Reitan, 1977; Reitan, 1955). For example, recent cross-sectional studies of the Wechsler tests for adults indicate that a single set of norms cannot be used for individuals at different age and education levels (Heaton, Grant, & Matthews, 1986).

Further, the use of a single summary score may mask differences in the pattern of strengths across ethnic backgrounds and gender in gifted children. Lesser, Fifer, and Clark (1965) reported results of a comparison of mental abilities in seven and eight year old first grade children from four ethnic groups and two socioeconomic levels in New York. Individuals of African-American, Chinese, Jewish, and Puerto Rican background were compared on four basic dimensions of mental ability using a modified version of the Hunter College Aptitude Scales for gifted children. The children were found to differ in pattern of mental abilities across ethnic background but not across socioeconomic status. Lesser et al. proposed that identification of the pattern of relative strengths and weaknesses of children from varied cultural backgrounds was a vital prerequisite to decisions about education in general and curriculum in particular.

Methodological Issues in Quasi-Experimental Assessment Studies

In reviewing the literature on the use of tests with different ethnic groups, several methodoligical issues become apparent. Some are inherent in the nature of quasi-experimental and archival design (e.g., the impossibility of random assignment to groups on key factors such as ethnic background or socioeconomic status), and limit the generalizability and applicability of the studies. Others result from a failure to control for moderator variables such as socioeconomic status and acculturation, or from a failure to use multiple methods within the same study. Several of these points will be illustrated in the following examination of studies subsequent to Lesser, et al.

Since publication of Lesser et al.'s findings, numerous investigators have made attempts to confirm differences in pattern of mental abilities across ethnic groups (e.g., Flaugher & Rock, 1972; Hennessy & Merrifield, 1976; Sitkei & Meyers, 1969). None of the subsequent studies have used the same tests, the same ethnic groups, or even children of the same ages. Most did not control for level of ability, and no single study looked at all of these confounds systematically. Despite these flaws, there has been a tendency among reviewers (e. g., Sattler; 1988) to characterize these attempts as "failure to replicate" the findings of Lesser et al.. Indeed, Sattler cited one study of 4 year olds (Sitkei & Meyers, 1969), one of junior high school students (Flaugher & Rock, 1972), and one of high school seniors accepted for admission to a major university (Hennessy & Merrifield, 1976) as evidence of failure to replicate. These studies were factor analytic in nature. Whereas the original work by Lesser et al. was based on an analysis of covariance method of comparing mean scores on tests across groups, the studies cited by Sattler, as well as elsewhere in the literature, compared factor structure of a given test across groups, and some included a comparison of factor means across the groups.

Several issues in quasi-experimental design and methodology become apparent when such studies are compared as "replications":

1. It is not valid to compare results of studies with populations of preschool children, elementary school children, junior high school students, and high school seniors. The increased exposure to

environments outside the cultural environment of the home as the child progresses through school is, for example, an enormous confound and provides a valid alternative hypothesis for the different findings.

2. Different assessment batteries can produce different results. Sitkei and Meyers (1969) used an extensive battery that included the Peabody Picture Vocabulary Test, which, as the authors acknowledged, is much less highly verbally loaded than the measures used by Lesser et al.. In fact, Sitkei and Meyers offered this lower verbal demand as one possible alternative hypothesis for the difference in their findings from those of Lesser et al..

3. Results at one level of intelligence do not necessarily generalize to others. Lesser et al. studied children matched on the basis of social class, gender, and ethnic membership; each of those matching variables has been correlated with differences in performance on tests of mental ability. Hennessy and Merrifield's (1976) subject pool was restricted to high school seniors who had been accepted for admission to universities in the fall. It seems unlikely that the two populations were comparable in their basic levels of mental ability, although Hennessy and Merrifield were careful to partial out the effects of socioeconomic status.

4. An analysis of covariance, directly comparing group means on subtest scores, provides different information than a factor analytic comparison, including a comparison of the factor means. Factor analysis is a data reduction technique for mathematically analyzing the intercorrelations between members of a set of variables and thus deducing a smaller set of factors. Those factors are assumed to account for the intercorrelations seen in the directly measurable original variables. The factors are arbitrarily named and interpreted (hopefully based on a theoretical model of the construct being studied); comparing factor means is <u>not</u> the same thing as comparing observable test score mean differences. A test could measure the same underlying mental abilities in four groups and yet produce a very different pattern of strengths and weaknesses in subtest performance across those four groups. In other words, it is possible that the groups show the same pattern of intercorrelations between subtests, but differ in the level of their original mean scores on subtests that critically load on a given factor. Group A could have consistently lower scores than Group B on all measures loading on Factor 1, and still show the same overall pattern of intercorrelations between those tests.

5. A difference in group means does not imply that most individuals in a group will have scores that fall in the direction of the observed group mean. Methodological rigor demands analysis of not only group means, but also individual data in conjunction with the group data. As Guertin, Frank, and Rabin (1956) point out: "One methodological shortcoming is the failure to distinguish between a mean diagnostic group profile and modal patterns of homogeneous subjects ... Only modal patterns are appropriate for diagnostic purposes" (p.239). For example, in a study of the WISC as a clinical diagnostic tool, Saccuzzo and Lewandowski (1976) found group differences on one subtest (Picture Arrangement) that would indicate that a preponderance of the individual scores could be expected to fall above the mean in the higher group. When individual cases were examined, however, it was found that less than half of the cases actually were above the mean, and there were no consistent tendencies on this subtest. Therefore, the subtest could not be used as a clinical indicator. In another example, these investigators found no group differences between the races in terms of WISC responses on a number of Wechsler's hypotheses regarding acting-out adolescents. On post-hoc analyses, however, there were clear differences between white males and black females that were masked by the overall means. If the issue is one of fairness of selection criteria, then individual scores must be examined in light of group means.

Again, the basic issue in the use of any test to select students for special programs is one of test use; fairness demands that the test be used in a way that will select equally from various groups, rather than invariably favoring (or disfavoring) members of one group over another. It is certainly possible to design a test that appears to measure the same underlying constructs across groups, and still find that the test differentially selects members of one group over another because of the way it is being used. That may be the case with the common practice of using the WISC-R to identify intellectual giftedness in children.

The San Diego City Schools Studies

Preliminary studies with a San Diego gifted population using a group measure of intelligence, the Developing Cognitive Abilities Test, indicated that predictors of giftedness depend on ethnic background (Saccuzzo, Hermanson, Dorne, Johnson, & Shamieh, 1990). For African-Americans, the quantitative score proved most predictive, while for Hispanics the spatial and total scores were most predictive of selection for gifted programs. Total scores alone were most predictive for only the Caucasians and Filipinos, who were overrepresented in the gifted and talented program. These findings suggested that giftedness may be expressed in unique patterns of abilities not best measured by a summary IQ score. Although the study was not (and was not intended to be) a replication of Lesser et al.'s work, the results did add weight to the idea that identifiable differences exist in the way giftedness is expressed across ethnic and cultural backgrounds. In further support of this hypothesis, a summary of academic performance of all students in gifted programs in San Diego City Schools indicated that Hispanic and African American students at all grade levels generally fall below other groups (and below the 90th percentile) only in reading and language (Millett, 1990). Analysis of VIQ - PIQ discrepancies in a random subset of this population also revealed differences that varied across ethnic background and as a function of the size of the discrepancy (Saccuzzo, Johnson, & Russell, 1992).

Given that the WISC-R is one of the single most widely used instruments for the identification of giftedness in the United States, and given the problem of underselection of certain ethnic groups, the goal of this study was to examine the feasibility of using the WISC-R in any way to select a balanced population of gifted children,since it would appear that a summary IQ score will not do so. The present work began with an analysis (Study I) of the WISC-R Verbal, Performance, and Full Scale scores of children who achieved a Full Scale IQ score at least two standard deviations above the mean (FSIQ $\geq$ 130). Children were compared and contrasted in terms of basic demographic factors such as ethnicity and gender, as well as on environmental factors thought to place them at risk for limited expression of their full potential (e.g., economic, language, and emotional factors). Verbal-Performance differences were examined in a study of base rates for the entire sample of intellectually gifted children as well as for subsamples defined on the basis of ethnic background, areas of risk, and documented low or high school achievement test scores. In spite of excellent discussions by Kaufman (1976) and Matarazzo and Herman (1984) on the difference between statistical and clinical significance, little has been documented about the relative rarity of specific VIQ-PIQ discrepancies in different populations of children. Finding that a child has a statistically significant VIQ-PIQ difference tells the clinician or educator nothing more than that the difference is probably real and not due to chance: it does not address the issue of the rarity of that difference in a given population or of its real world significance, nor does it address the likelihood that such a VIQ-PIQ difference is associated with low achievement. Only by studying actual occurrence in a population can we address such issues. Kaufman (1976) noted no differences in base rates across ethnic backgrounds in children with IQ values of at least 120 in the standardization sample. Two serious problems with that finding are that Kaufman did not take into account the direction of the difference (only the size), and that there were almost certainly not enough non-Caucasian children in the sample at those IQ levels to have found a difference even if it existed: the total number at that IQ level was 213. The present study was undertaken to provide accurate base rates for a large, culturally diverse sample of gifted children, with the hope that more evidence could be provided to dispel invalid uniformity assumptions and to shed light on this gifted population.

Study II examined the feasibility of deriving a single set of criteria from the WISC-R to select a proportionately representative, ethnically diverse sample of children for inclusion in programs for the gifted by exploring two alternative hypotheses: (1) there exists a single pattern of WISC-R subtest scores that predicts giftedness equally across gender and ethnic background; or (2) there is a unique pattern of cognitive strengths and thus different predictors of giftedness for each group. Ethnic backgrounds represented included African-American, Asian, Caucasian, Filipino, and Hispanic.

General Considerations in the Use of Tests for Giftedness

Again, the basic issue is one of competent test use. Despite ongoing discussion, acknowledgment of the limitations of IQ tests, and exhortations to use these tests in an informed manner (Borland, 1986; Kaufman & Harrison, 1986; Robinson & Chamrad, 1986; Sternberg, 1982), no single

study to date in the educational or psychological literature has directly and adequately addressed the issue of fairness of the use of this test in an ethnically diverse population of potentially gifted children. Goals of this study included possible explication of a more fair and adequate use of the WISC-R in identification of giftedness, a discussion of selection bias that results from its use, and further understanding of the limits as well as the full potential of the WISC-R in the selection of students from diverse backgrounds for gifted programs in schools.

Benefits to be gained from improved methods of selection are substantial. If we are to increase the number of underrepresented minorities in the professions, as morally and legally mandated, it is vital to identify and encourage those individuals as early as possible. What are the consequences if we continue to fail in this endeavor? They are perhaps best summed by D. D'Souza (1991) in his description of the experience of one university noted for its aggressive affirmative action policy:

> ...the academic difficulties encountered by affirmative action students who find it impossible to compete effectively with other, better-prepared students, are reflected in Berkeley's extremely high dropout rate for Hispanic and black undergraduates. Whites and Asians graduate from Berkeley at about the same rate: 65-75 percent. That is to say that 25-35 percent drop out before graduation. Hispanics graduate at under 50 percent. More than half drop out. Blacks graduate at under 40 percent. More than 60 percent drop out.
>
> ...Berkeley does not release the number of blacks and Hispanics admitted on affirmative action who drop out, but these data are contained in a confidential internal report which tracks freshmen enrolled in 1982. By 1987, five years later, only 18 percent of blacks admitted on affirmative action had graduated from Berkeley; blacks admitted in the regular program graduated at a 42 percent rate. Similarly, only 22 percent of affirmative action Hispanics finished in five years, compared with 55 percent for other Hispanics. The most recent figures suggest that approximately 30 percent of black and Hispanic students drop out before the end of their freshman year; in the words of the report, they seem to stay "only long enough to enhance the admissions statistics." (p. 39)

I would propose that the key phrase is "better prepared" students and suggest that such preparation must begin as early in elementary education as possible.

Inclusion of more equitable proportions of high risk children in gifted programs is a goal much sought in education. A unique opportunity exists in San Diego to study selection procedures for gifted and talented programs: a large, ethnically diverse metropolitan population plus a school district that continues to demonstrate its commitment to identification of underrepresented and disadvantaged students.

II. Methods

Two studies were completed: I) an analysis of the base rates of VIQ-PIQ differences in a population of intellectually gifted children, defined as those who achieve a Full Scale IQ score at least two standard deviations above the mean, and II) an examination of the use of the WISC-R to select a proportionately representative and ethnically diverse sample of gifted children from the population of children identified as potentially gifted.

Subjects

Each child in this study was identified as potentially gifted based on achievement test data, teacher evaluation (Appendix A) and recommendation, and a social case study analysis (Appendices B and C). The social case study analysis included an assessment of 6 areas of potential risk for achievement and expression of full potential: 1) cultural, 2) economic, 3) emotional, 4) environmental, 5) health, and 6) language. Cultural risk included cultural values and beliefs that differ from the those of the dominant culture, or limited experience in the dominant culture. Economic risk included parental unemployment or household income low enough to qualify the child for the free lunch program. Emotional risk

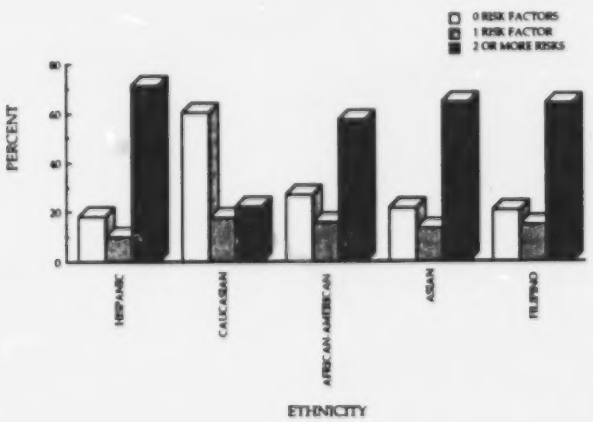
encompassed such factors as death of a parent, child abuse, major psychiatric illness in the home, or extended absence of a parent due to military service. Environmental risk included transiency (three or more school moves) and excessive absences from school due to home responsibilities such as child care responsibility or working to help support the family. Health factors included vision, speech, or hearing deficits requiring designated instructional service, motor problems requiring adaptive physical education, or diseases such as asthma. Children at risk due to language included those for whom English is a second language and those not fluent in English. For the purposes of the current project, each child was assigned a value for level of risk: 0 if no identified risk, 1 if risk was identified in one and only one of the areas described above, and >1 if more than one area of risk was identified for that child.

Ethnic background was determined by self-report, based on an information questionnaire completed by parents at the time of their child's enrollment in the school district. Problems are inherent in such self-report, including the resultant heterogeneity of each group. For example, the child of one Caucasian and one Hispanic parent may be reported to be Caucasian or to be Hispanic, depending on societal factors that enter into the parents' decision to report: Being considered Caucasian might seem to confer some obvious dominant culture benefits, but being designated Hispanic might open opportunities for scholarship or for special tutorial programs in a given school.

Ethnic categories designated by this district are broad and in themselves create heterogenious groups: 'Hispanic' includes those from Mexico, Cental and South America, Puerto Rico, Cuba, and Spain. Children from those different ethnic and cultural backgrounds may be more dissimilar among themselves than they are from children of other ethnic categories such as African-Americans or Caucasians.

Under the selection model used by this school district, each of the children to be certified gifted must have achieved a score on a nationally standardized group achievement test in the 90th percentile or higher. Since not every child is referred for evaluation, several sources of referral bias may begin at this stage of the process (e.g., based on gender, culture, or verbal skill level). Each then was further evaluated with a nationally standardized individual test of intelligence. Children were subsequently certified gifted in one of two ways: 1) an IQ score two standard deviations above the national mean or higher (e.g., WISC-R FSIQ $\geq$ 130), or 2) an individual IQ score $\geq$ 120 plus the presence of two or more identified areas of risk, as discussed above. An examination of the risk factors demonstrated considerable heterogeneity within each ethnic group and across ethnic groups, as would be expected (see Figure 1). Again, problems in the use of self-report data can be seen. Certain groups may tend to under-report, and teachers may tend to selectively report factors seen more frequently in one group than in another (e.g., language, which is especially obvious without much depth of knowledge about the child or family).

Figure 1. Within each ethnic group, the percentage at each level of risk in the population of children referred as potentially gifted.



Each child in this study was given the Wechsler Intelligence Scale for Children-Revised (WISC-R) by a school psychologist as part of the evaluation process between 1984 and 1991. The two supplemental subtests (Mazes and Coding) were not routinely administered in this district, and the Comprehension and Digit Span subtests were given to too few of the children to be included in multivariate analyses. The omission of Comprehension and Digit Span for so many children introduced another possible source of bias, in that prorated IQ scores were used for those children and may not represent the same Full Scale score as would have resulted from the inclusion of all subtests. Furthermore, the decision to administer those two subtests to some but not all children may have been based on systematic differences in attributes such as verbal facility and/or cultural and language differences.

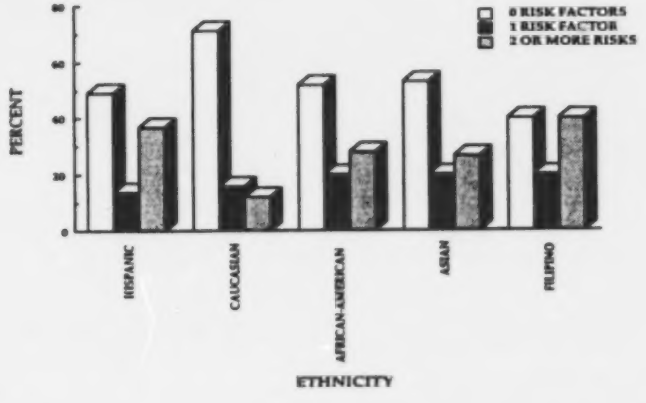
Study 1. For the study of observed base rates of VIQ-PIQ differences, the sample included every African-American, Asian, Caucasian, Filipino, and Hispanic child who achieved a Full Scale IQ score of at least 130 (by definition, two standard deviations above the mean) on the WISC-R between the years 1984 and 1991, inclusive. Forty six percent were female. Ethnic composition of the sample is summarized in Table 1.

Table 1. *Composition of the VIQ-PIQ base rate sample*

		Percent of each group at each Level of Risk		
Group	Number	0	1	>1
African-American	252	52	20	28
Asian	202	53	20	27
Caucasian	4895	71	16	12
Filipino	182	40	20	40
Hispanic	265	49	14	37
Total	5796			

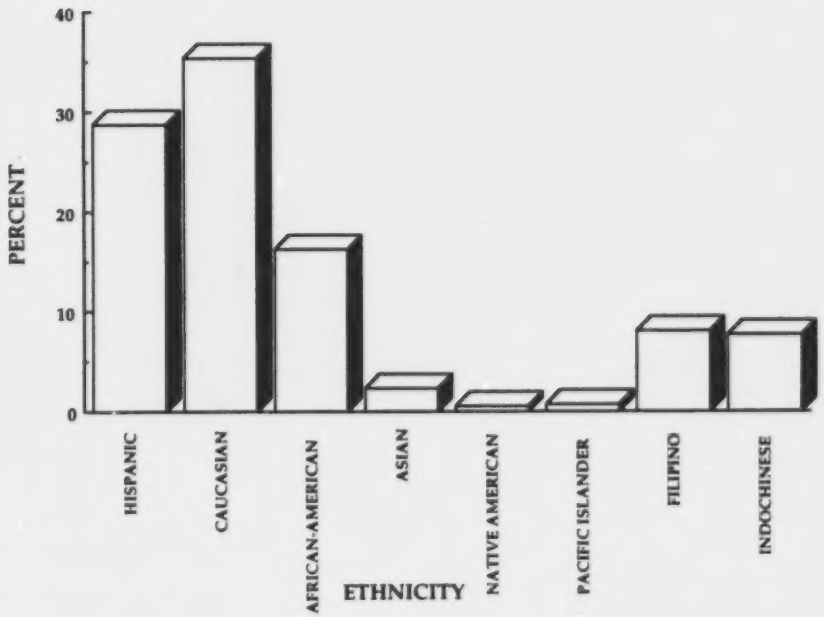
Heterogeneity of levels of risk for these children, within and across ethnic groups, can be seen in Figure 2. Comparison of Figures 1 and 2 strikingly demonstrates the WISC-R disadvantage associated with a high risk environment, for children of every ethnic background. In each ethnic group, children from high risk environments differentially tended to score below 130 in FSIQ on the WISC-R and so were selected out of the sample for the base rate study. Use of a single cut-off score by a school district would obviously tend to exclude those children from enrichment programs as well.

Figure 2. Within each ethnic group, the percent at each level of risk in the population of children with FSIQ at least 130.



Study II. 19,826 children were identified as potentially gifted by the San Diego City School District in the years from 1984 through 1991. A total of 8396 children were subsequently administered the WISC-R, while others were evaluated with other instruments such as the Kaufman Assessment Battery for Children (Kaufman & Kaufman, 1983). From the group administered the WISC-R, a random sample of 1438 (713 female) was chosen to be ethnically proportionate to the composition of the district population in the academic year 1990-1991 (see Figure 3). The random sample consisted of 258 African-American, 36 Asian, 560 Caucasian, 128 Filipino, and 456 Hispanic children. Size of the sample was limited by the proportionately small number of Hispanic children administered the WISC-R, as compared to their numbers in the district population. In its determination to find equitable selection methods, this school district uses tests other than the WISC-R whenever possible with the predominantly Spanish-speaking members of its large population of Hispanic children.

Figure 3. San Diego Unified School District ethnic composition, 1991/1992.



III. Results

Study I: Base Rates for VIQ-PIQ Differences

Descriptive statistics for the WISC-R scores of the sample of 5796 children with Full Scale IQ values of at least 130 are presented in Table 2.

Table 2. *Verbal, Performance, and Full Scale Scores as a Function of Ethnic Group*

Group	VIQ Mean	(*sd*)	PIQ Mean	(*sd*)	FSIQ Mean	(*sd*)
African-American	136 .2	(8.02)	129.6	(9.00)	136.7	(6.09)
Asian	135.0	(9.97)	136.6	(8.78)	139.8	(7.18)
Caucasian	136.4	(8.55)	132.3	(9.08)	138.4	(6.56)
Filipino	132.3	(9.63)	134.5	(8.92)	137.3	(6.18)
Hispanic	135.2	(8.89)	133.6	(7.95)	138.4	(6.33)

Preliminary analyses were conducted to examine the trends in this group of intellectually gifted children. Gender effects were analyzed in a 2 (Gender) by 3 (Test Score) mixed repeated measures analysis of variance. Significant main effects were found for Gender, $F(1, 5794) = 53.67$, $p < .001$, but there was no interaction effect. Boys, on the average, scored higher than girls, as can be seen in Table 3. Given the standard error of measurement of the WISC-R, although the differences were statistically significant, they were clinically irrelevant.

Table 3. *Verbal, Performance, and Full Scale Scores as a Function of Gender*

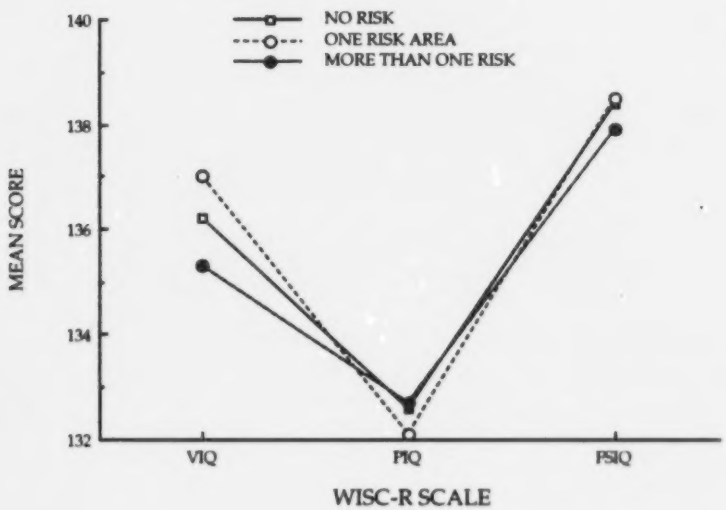
Gender	VIQ Mean	(*sd*)	PIQ Mean	(*sd*)	FSIQ Mean	(*sd*)
Female	135.5	(8.39)	131.9	(8.83)	137.6	(6.24)
Male	136.8	(8.85)	133.0	(9.25)	138.9	(6.77)

Verbal, Performance, and Full Scale IQ values for each ethnic group were analyzed in a 5 (Ethnicity) X 3 (Test Score) mixed repeated measures analysis of variance. Results revealed significant main effects for Ethnicity, $F(4, 5791) = 7.41$, $p < .001$ and for Test Score, $F(2, 5791) = 200.54$, $p < .001$. These main effects must, however, be interpreted in light of the significant Ethnicity by Test Score interaction, $F(8, 5791) = 25.70$, $p < .001$. As can be seen in Table 2 and confirmed in post hoc multiple Scheffé comparisons, Filipino children were significantly lower in Verbal IQ scores than African-American, Caucasian, or Hispanic children. On the other hand, Filipinos were higher in Performance IQ than African-Americans or Caucasians, and African-Americans were lower than any other group. Clear differences in pattern of strengths and weaknesses among these gifted children seem apparent.

To investigate the possibility that observed ethnic group differences in Verbal IQ scores could be due primarily to differences in risk status, a oneway analysis of covariance was performed with level of risk as the covariate. Results indicated that level of risk was a nonsignificant covariate, and that ethnic status remained a significant effect, $F(4,5790) = 11.50$, $p < .001$, regardless of risk.

In a series of oneway analyses of variance, level of identified risk was found to have a significant effect only on Verbal IQ scores, $F(2, 5793) = 9.46$, $p < .001$, but not on Performance or Full Scale IQ scores. Post hoc Scheffé comparisons revealed that those with one and only one identified area of risk obtained Verbal scores significantly higher than those with no risk, whose scores were higher than those with more than one risk area (see Figure 4).

Figure 4. WISC-R scores as a function of level of risk.



Thus the presence of multiple areas of risk or hardship in a gifted child's environment appears to be associated with lower performance on the Verbal Scale of the Wechsler, while the presence of one unspecified risk factor alone does not.

In an effort to understand the finding that children with one and only one risk had higher mean VIQ than those at no risk, a series of hypotheses was tested. The first hypothesis was that, among children with a single identified risk, either ethnic groups with higher mean VIQ (i.e., Asians and Caucasians) or males (who had higher VIQ than females) were disproportionately highly represented. A oneway analysis of variance compared VIQ in the two levels of risk, with ethnic group membership and gender as covariates. Ethnicity was a significant covariate, $F(1,4892) = 9.39$, $p < .01$, as was gender, $F(1, 4892) = 27.45$, $p < .001$. Risk level, however, remained a significant main effect, $F(1,4892) = 6.87$, $p < .01$. Therefore, the VIQ differences across level of risk did not appear to be a simple function of ethnicity or gender alone. In fact, a 2 (Risk Level) X 2 (Gender) X 5 (Ethnicity) ANOVA demonstrated significant main effects for Level of Risk, $F(1,4876) = 7.27$, $p < .01$, Gender, $F(1,4876) = 27.78$, $p < .001$, and Ethnicity, $F(1,4876) = 6.43$, $p < .001$. None of the interaction effects were significant. Since neither gender nor ethnic background accounted for the differences in VIQ across risk, an alternative hypothesis that type of risk accounted for the higher mean in one-risk children was investigated in a oneway analysis of covariance with type of risk as the covariate. Type of risk was a significant covariate, $F(1,4893) = 9.24$, $p < .01$. When the variance accounted for by type of risk was removed, level of risk was no longer a significant effect. To further elucidate this finding, frequencies of ethnic background and gender across type of risk were examined in children with only one area of risk. Most frequent was

emotional risk (30.5% of the total), followed by health (26.1% of the total) and environmental (19.0% of the total). The presence of cultural, economic, or language hardship alone was relatively rare (2.2%, 10.1%, and 11.7%, respectively). Within the group at emotional risk, 89.8% of the children were Asian and Caucasian; 53.0% were male. Among those at health risk, 96.0% were Asian and Caucasian; 64.9% were male. In the environmental risk group, 89.1% were Asian and Caucasian; 56.8% were male. Type of risk appears to be a mediator for ethnicity and for gender, and the higher mean VIQ scores in children with only one risk area appear to be explainable in terms of a higher proportion of males and of Asians and Caucasians (all associated with higher mean VIQ) in the group of children identified with only emotional, health, or environmental risk than in the overall sample.

Base rates for the difference between Verbal and Performance IQ score were obtained and are summarized in Tables 4 through 8. Ranges were defined to be consistent with those of Matarazzo and Herman (1984), so that comparisons with their findings could be made.

Table 4. *African-Americans: Cumulative Percentage Distributions of the Difference Between WISC-R VIQ and PIQ*

Size of the Difference Between VIQ and PIQ	%V>P (+ Difference)	%P>V (-Difference)	Sum of WISC-R + and - Differences	Cumulative Percentage
30 and above	3.97	0	3.97	100.00
26-29	3.57	0	3.57	96.03
22-25	5.56	1.98	7.54	92.46
19-21	5.16	.79	5.95	84.92
16-18	8.33	1.19	9.52	78.97
13-15	6.35	1.19	7.54	69.45
10-12	5.56	3.17	8.73	61.91
7-9	9.92	4.37	14.29	53.18
4-6	6.75	7.94	14.69	38.89
1-3	11.11	9.92	21.03	24.20
0	—	—	—	3.17

Table 5. *Asians: Cumulative Percentage Distributions of the Difference Between WISC-R VIQ and PIQ*

Size of the Difference Between VIQ and PIQ	%V>P (+ Difference)	%P>V (-Difference)	Sum of WISC-R + and - Differences	Cumulative Percentage
30 and above	0	.99	.99	100.00
26-29	.99	1.49	2.48	99.05
22-25	2.48	3.96	6.44	96.57
19-21	2.48	2.97	5.45	90.13
16-18	3.47	4.95	8.42	84.68
13-15	4.46	4.46	8.92	76.26
10-12	5.94	7.43	13.37	67.34
7-9	5.94	10.40	16.34	53.97
4-6	9.9	8.91	18.31	37.63
1-3	8.91	6.44	15.35	18.82
0	—	—	—	3.47

Table 6. *Caucasians: Cumulative Percentage Distributions of the Difference Between WISC-R VIQ and PIQ*

Size of the Difference Between VIQ and PIQ	%V>P (+ Difference)	%P>V (-Difference)	Sum of WISC-R + and - Differences	Cumulative Percentage
30 and above	2.35	.16	2.51	100.00
26-29	2.25	.57	2.82	97.51
22-25	3.49	1.41	4.90	94.69
19-21	5.05	1.53	6.58	89.79
16-18	5.99	2.49	8.48	83.21
13-15	6.07	2.80	8.87	74.73
10-12	8.09	5.03	13.12	65.86
7-9	8.83	5.78	14.61	52.74
4-6	8.95	7.84	16.79	38.13
1-3	9.85	8.34	18.19	21.34
0	—	—	—	3.15

Table 7. *Filipinos: Cumulative Percentage Distributions of the Difference Between WISC-R VIQ and PIQ*

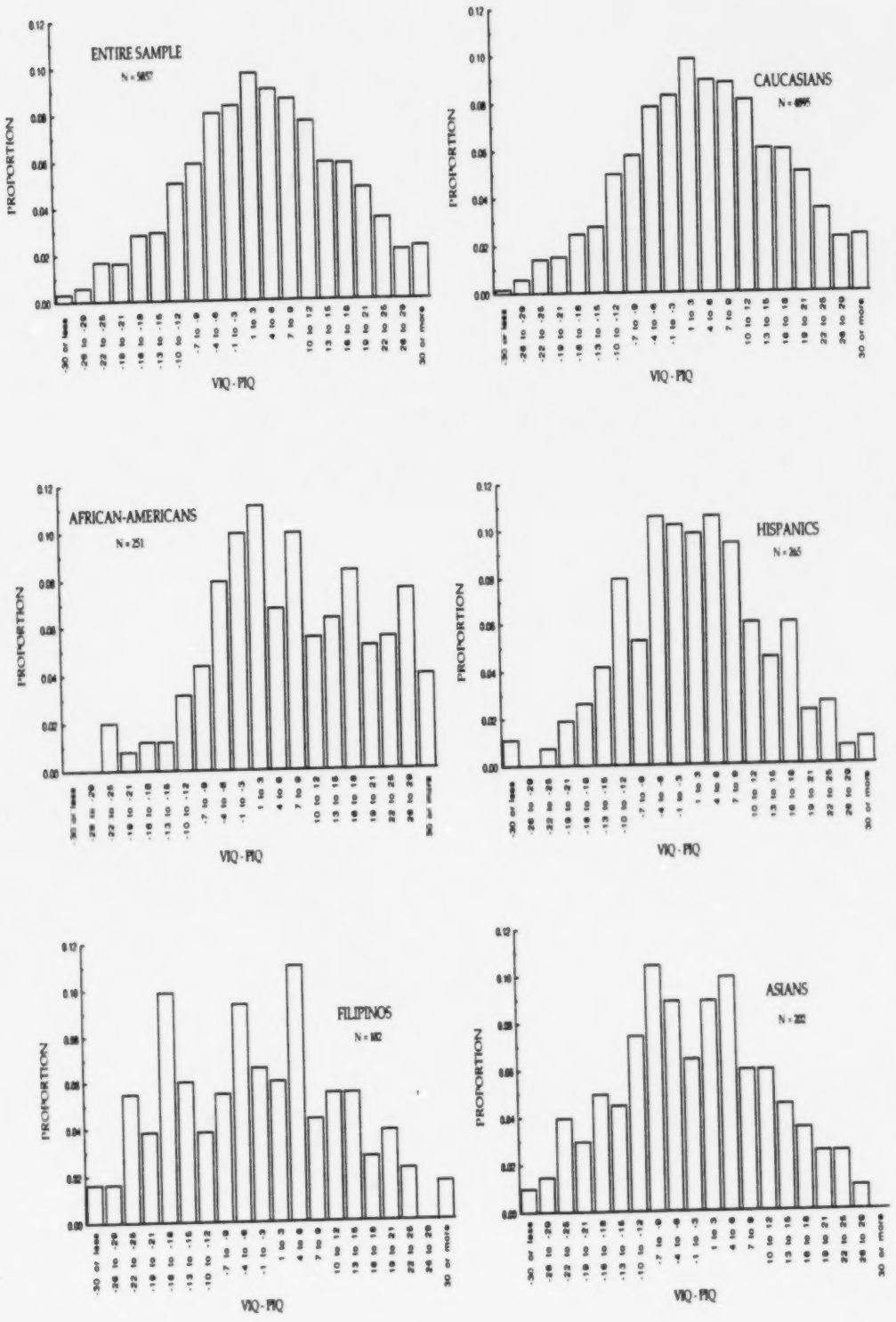
Size of the Difference Between VIQ and PIQ	%V>P (+ Difference)	%P>V (-Difference)	Sum of WISC-R + and - Differences	Cumulative Percentage
30 and above	1.65	1.65	3.30	100.00
26-29	0	1.65	1.65	96.70
22-25	2.20	5.49	7.69	95.06
19-21	3.85	3.85	7.70	87.37
16-18	2.75	9.89	12.64	79.67
13-15	5.49	6.04	11.53	67.03
10-12	5.49	3.85	9.34	55.50
7-9	4.40	5.49	9.89	46.16
4-6	11.00	9.34	20.34	36.27
1-3	6.04	6.59	12.63	15.93
0	—	—	—	3.30

Table 8. *Latinos/Hispanics: Cumulative Percentage Distributions of the Difference Between WISC-R VIQ and PIQ*

Size of the Difference Between VIQ and PIQ	%V>P (+ Difference)	%P>V (-Difference)	Sum of WISC-R + and - Differences	Cumulative Percentage
30 and above	1.13	1.13	2.26	100.00
26-29	.75	0	0.75	97.72
22-25	2.64	.75	3.39	96.97
19-21	2.26	1.89	4.15	93.58
16-18	6.04	2.64	8.68	89.43
13-15	4.53	4.15	8.68	80.75
10-12	6.04	7.92	13.96	72.07
7-9	9.43	5.28	14.71	58.11
4-6	10.57	10.57	21.14	43.40
1-3	9.81	10.19	20.00	22.26
0	—	—	—	2.26

Inspection of these tables suggests striking differences between ethnic groups. To examine those differences, the VIQ - PIQ frequency distribution for each ethnic group was compared to a reference distribution using a Chi Square test with 20 degrees of freedom. The reference distribution chosen was that of the standardization sample for the Wechsler Adult Intelligence Scale-Revised, reported by Matarazzo and Herman (1984), since those authors reported direction as well as magnitude of the VIQ-PIQ difference. Hispanics and Asians were not found to differ from the WAIS-R standardization sample. African-Americans, $\chi^2(20, N = 252) = 196.9$, $p<.001$, Caucasians, $\chi^2(20, N = 4895) = 1382.6$, $p<.001$, and Filipinos, $\chi^2(20, N = 182) = 90.7$, $p<.001$, did differ significantly from the reference distribution. The nature of those distributions is shown in Figure 5.

Figure 5. Distributions of (VIQ - PIQ) differences as a function of ethnic group.



BEST COPY AVAILABLE

Again we see the trend for African-American and Caucasian children to have higher VIQ than PIQ, while the reverse is true for Filipino children. The previous analyses found the trend in group mean scores. The Chi Square differences between VIQ and PIQ confirm those findings in individuals and further strengthens the evidence for differences in patterns of strengths and weaknesses across ethnic background.

Given these differences in distributions between ethnic groups, it becomes crucial to look at population incidence of large VIQ-PIQ discrepancies as a function of ethnic background. Only in this way can we determine whether an event that is rare in one group, and is taken as a clinical indicator of abnormality, also holds for other groups. Within each ethnic group, occurrences of magnitudes of VIQ-PIQ discrepancies were counted so that population rarity could be compared with statistical significance (as presented in the WISC-R manual) for each group. That is, a VIQ-PIQ difference of 12 points has been found to be statistically significant at the .05 level. This finding is frequently misinterpreted to mean that only about 5% of normal children will have a difference of that magnitude. However, Kaufman (1976) pointed out that approximately 30% of normal children with average intelligence have discrepancies at least that high, as do 36% of children in the standardization sample with IQ scores of at least 120. In Table 9, the difference required for statistical significance is compared to that actually observed in each of the ethnic groups. For example, a difference of 12 points is needed to be sure (within an error probability of .05) that a child's Verbal and Performance abilities are significantly different. For the Asian children in this sample, however, a difference of 25 points or more is needed in order for the difference to be rare enough to be observed only about 5 percent of the time.

Table 9. *Empirically Different Magnitudes of VIQ-PIQ Discrepancies, as a Function of Ethnic Group*

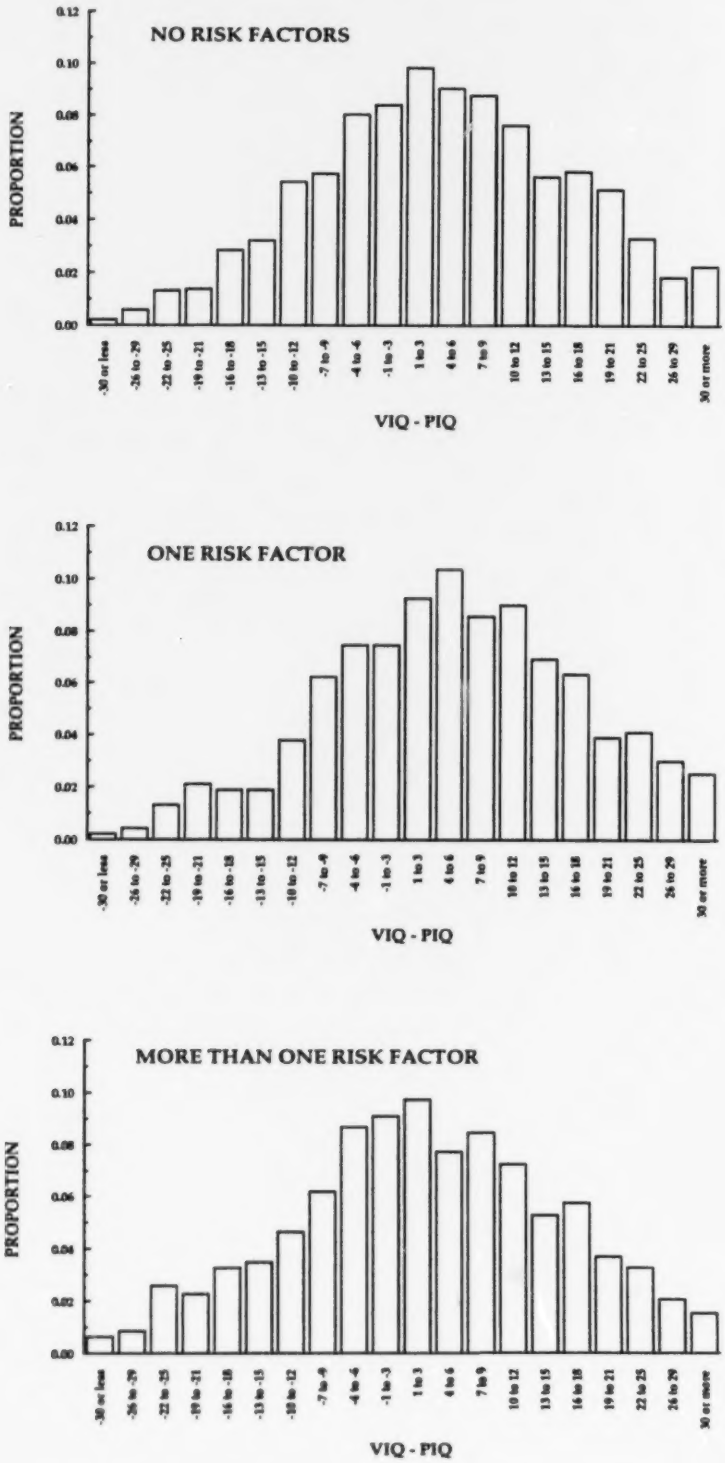
	Magnitude of Difference Required Statistically*	Magnitude of Difference Empirically Observed at Each Level of Probability				
p value		Caucasian	Hispanic	Afr.Amer.	Asian	Filipino
.15	8	20	18	22	19	21
.10	10	23	19	25	22	23
.05	12	27	23	29	25	27
.01	15	34	40	35	30	38

* to be reliably different from 0

Considerable variation between groups can be seen in Table 9. Although a VIQ-PIQ difference of 30 points is rare in the gifted Asian population of our sample (occurring only about once in every one hundred children), 5 in every one hundred African-American children are observed to have that difference, and even more children in each of the other three groups. One can easily imagine a scenario in which, for example, norms are set using a predominantly Asian population, rare (less than 5% of the population) VIQ-PIQ differences are defined to be a diagnostic indicator for learning disabilities, and that standard is used for all children. In this particular gifted sample, such a criterion could lead to labelling twice as many Caucasian, Filipino, and African-American children as Asian or Hispanic learning disabled. The scenario is admittedly an exaggerated one and it is to be hoped that in actual practice one single test is never the sole criterion for diagnostic or placement decisions.

The effect of level of risk was further examined as base rates among children at no, low, and high (2 or more identified areas of risk) risk were compared (see Figure 6).

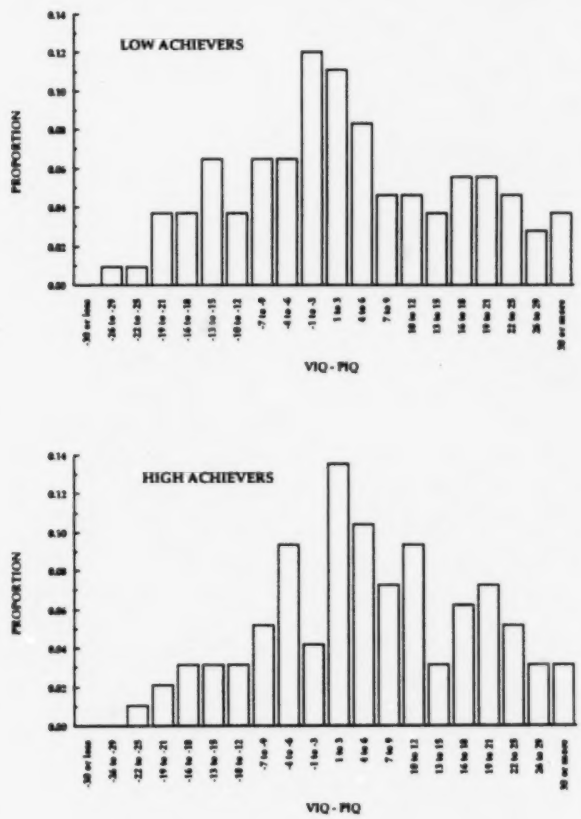
Figure 6. Distributions of (VIQ - PIQ) differences as a function of level of risk.



Distributions were statistically compared using Kolmogorov-Smirnov 2-sample tests. Children with no identified risk differed from those with one risk ($Z = 1.526$, $p < .05$), and children with only one risk differed from those with more than one risk ($Z = 1.951$, $p < .001$). As can be seen in the figure, children from high risk backgrounds more frequently tended to have higher PIQ than VIQ. This comes as no surprise, in light of findings from group means that children at high risk have lower mean VIQ. Each of these children achieved a Full Scale IQ of at least 130. In order to accomplish that in the face of a disadvantaged VIQ, PIQ must be even higher than for those at no risk. Again, we see differences in pattern across groups.

Finally, subsamples of this demonstratedly gifted sample were selected so that rates of VIQ-PIQ differences could be compared in gifted high and low achievers. For this purpose, scores on the California Test of Basic Skills (CTBS) were obtained. Two subsamples were selected; 96 children whose CTBS scores were all at a stanine of 9 were designated "high achievers", and 108 children whose CTBS scores were all at a stanine of 6 or below were called "low achievers". Single classification ANOVAs revealed that the groups did not significantly differ in PIQ; for high achievers, $M = 132.2$ (SD=9.7), while for low achievers M=130.6 (SD=9.1). Low achievers were, however, significantly different from high achievers in VIQ, $F(1,203) = 13.49$; $p < .001$. Group means were 137.8 (SD=8.5) and 133.4 (SD=7.8), respectively.

Figure 7. Distribution of VIQ-PIQ differences at the extremes of achievement.



VIQ - PIQ distributions for the two groups are shown in Figure 7. No significant differences were found between the two distributions (Kolmogorov-Smirnov $Z = 1.007$, $p = .263$). This implies that use of large VIQ-PIQ discrepancy as an indicator of risk for low achievement is indeed fallacious, since relatively large VIQ-PIQ discrepancies are as likely to be seen in high achievers as in low achievers.

Study II: Multivariate attempts to use the WISC-R to select an ethnically balanced gifted population.

An ethnically balanced random sample of 1438 children identified as potentially gifted was generated. Mean scores on the eight subtests of the WISC-R routinely administered in the district are summarized in Table 10.

Table 10
WISC-R Scores in a Randomly Balanced Sample of Children Identified Potentially Gifted

Score	Entire Sample	African-American	Asian	Caucasian	Filipino	Hispanic
FSIQ	130.6*	127.0	134.8	133.1	128.5	129.8
	(11.3)**	(11.9)	(10.2)	(10.0)	(11.4)	(11.8)
VIQ	129.1	127.5	129.8	132.0	124.1	127.8
	(12.1)	(12.1)	(12.4)	(11.0)	(12.5)	(12.5)
PIQ	125.6	120.4	132.8	127.1	127.2	125.6
	(12.3)	(12.8)	(11.6)	(11.4)	(12.3)	(12.3)
Information	13.5	12.9	14.1	14.1	12.9	13.3
	(2.5)	(2.4)	(3.1)	(2.4)	(2.4)	(2.6)
Similarities	15.8	15.7	15.2	16.2	14.8	15.8
	(2.4)	(2.5)	(2.5)	(2.2)	(2.7)	(2.4)
Arithmetic	13.9	13.5	14.4	14.3	13.6	13.8
	(2.4)	(2.4)	(2.3)	(2.3)	(2.3)	(2.4)
Vocabulary	14.7	14.6	14.9	15.2	13.8	14.2
	(2.6)	(2.5)	(2.6)	(2.4)	(2.8)	(2.7)
Picture Completion	13.2	12.7	13.5	13.3	13.0	13.4
	(2.4)	(2.3)	(2.2)	(2.4)	(2.4)	(2.4)
Picture Arrangement	14.0	13.3	14.5	14.2	14.0	14.1
	(2.7)	(2.7)	(2.7)	(2.7)	(3.0)	(2.7)
Block Design	14.0	12.7	16.2	14.4	14.7	13.8
	(3.0)	(3.0)	(2.8)	(2.8)	(2.7)	(2.9)
Object Assembly	13.3	12.4	13.8	13.6	13.3	13.3
	(2.8)	(2.9)	(2.8)	(2.6)	(2.9)	(2.7)

* Mean
** Standard Deviation

Inspection of Table 10 reveals the problem experienced by any diverse school district in its efforts to provide equal access to gifted programs based primarily on Full Scale IQ as measured by the WISC-R. As has happened in San Diego City Schools, Caucasians and Asians will be over-represented, while Hispanics and African-Americans will be under-represented. Assuming that the WISC-R does indeed predict academic achievement and that an ethnic balance in gifted programs is a desirable and in fact necessary goal, each ethnic subsample was divided on the basis of FSIQ: the upper 70% of each group was designated "gifted" for the purposes of the following analyses, and the lower 30% of each was designated "nongifted". Those percentages were estimated based on the overall number of children referred for individual testing versus the 70% finally selected for inclusion in gifted enrichment classrooms.

Stepwise multiple linear regression analyses were carried out on the scaled scores of the whole sample, as well as each ethnic subsample, in order to determine which subtests of the WISC-R best predict giftedness for each group. Results are summarized in Table 11.

Table 11. *Stepwise Multiple Linear Regression Models to Predict Giftedness*

Sample	Subtests in the Model	ß	*R*	R^2
Entire Sample	Vocabulary	.156		
	Object Assembly	.172		
	Picture Completion	.153		
	Similarities	.167		
	Block Design	.150		
	Picture Arrangement	.144		
	Arithmetic	.105		
	Information	.101	.696	.485
African-Americans	Information	.180		
	Object Assembly	.189		
	Similarities	.163		
	Block Design	.150		
	Picture Arrangement	.140		
	Arithmetic	.131		
	Vocabulary	.114	.659	.483
Asians	Information	.457		
	Block Design	.357	.604	.365
Caucasians	Object Assembly	.236		
	Vocabulary	.181		
	Picture Completion	.183		
	Arithmetic	.159		
	Block Design	.172		
	Similarities	.157		
	Picture Arrangement	.120		
	Information	.112	.753	.567
Filipinos	Picture Arrangement	.291		
	Picture Completion	.271		
	Block Design	.284		
	Similarities	.274	.699	.489
Hispanics	Similarities	.226		
	Object Assembly	.168		
	Information	.154		
	Picture Completion	.151		
	Picture Arrangement	.154		
	Vocabulary	.161		
	Block Design	.131	.735	.533

For each group except Asians, the best stepwise selection model was able to account for approximately 50% of the variance or more: for Asians, R^2 was only .36. Variables in the model differed across ethnic groups, as well. For Caucasians, as for the sample as a whole, all subtests entered into the equation. For Hispanics, only Arithmetic failed to enter, while for African-Americans the Picture Completion subtest did not enter the model. The best-fitting model for Filipinos included Picture Arrangement, Picture Completion, Block Design, and Similarities. Only two subtests were include in the model for Asians: Information and Block Design. Again we see differences in pattern of strengths and weaknesses, reflected in different predictors of giftedness across ethnic background.

To determine the efficacy of the best predictive model, discriminant analysis was performed for the entire sample using all subtests as predictors and giftedness as the criterion. With two groups (gifted and non-gifted), one discriminant factor was generated. Results are summarized in Table 12.

Table 12. *Discriminant Function Coefficients for the Identification of Giftedness in the Entire Ethnically Balanced Sample*

Standardized Coefficients		Pooled Correlations Between Subtests and the Discriminant Function	
Information	.252	Similarities	.566
Similarities	.376	Vocabulary	.555
Arithmetic	.111	Information	.549
Vocabulary	.265	Object Assembly	.461
Picture Completion	.270	Block Design	.437
Picture Arrangement	.273	Picture Completion	.424
Block Design	.225	Picture Arrangement	.412
Object Assembly	.298	Arithmetic	.347

False positives, false negatives, and hit rates, in percentages, are provided for the whole sample and for each ethnic group within that sample in Table 13.

Table 13. *Hit Rates, False Positives, and False Negatives for the Best Overall Model*

Group	Hit Rate	False Positives*	False Negatives**
Entire Sample	89.3	7.5	19.9
African-Americans	81.7	0	23.6
Asians	93.9	33.3	0
Caucasians	87.9	42.9	.5
Filipinos	89.6	3.6	12.4
Hispanics	95.0	4.2	5.3

* of those who were not gifted, the percent called "gifted"
** of those who were gifted, the percent called "nongifted" by the model

The most critical errors are represented in the "false negatives" column of the table. Those numbers represent children who have unusually high potential that would not be recognized. Those children would be denied a chance to excel in special programs for the intellectually gifted. When we examine false positive and negative rates for subgroups, we see the repetitive pattern of over-selection of Caucasians and Asians accompanied by the under-selection of African-Americans. The one group for whom this model is an improvement is Hispanics. **Thus we demonstrate that no one single model using the WISC-R, no matter how sophisticated and complex, will select an ethnically proportionate sample for inclusion into enrichment programs for the gifted.**

The efficacy of individual models of selection, based on ethnic background, was investigated by performing discriminant analyses on each ethnic subsample, using all available subtests of the WISC-R as predictors and giftedness as the criterion. Results are summarized in Tables 14 through 18.

Table 14. *African-Americans: Discriminant Function Coefficients for the Identification of Giftedness*

Standardized Coefficients		Pooled Correlations Between Subtests and the Discriminant Function	
Information	.298	Information	.573
Similarities	.287	Object Assembly	.549
Arithmetic	.216	Arithmetic	.522
Vocabulary	.195	Similarities	.517
Picture Completion	.132	Block Design	.512
Picture Arrangement	.254	Vocabulary	.500
Block Design	.267	Picture Arrangement	.455
Object Assembly	.310	Picture Completion	.364
Eigenvalue .9512		Wilks' Lambda .513	

Table 15. *Asians: Discriminant Function Coefficients for the Identification of Giftedness*

Standardized Coefficients		Pooled Correlations Between Subtests and the Discriminant Function	
Information	.513	Information	.648
Similarities	.011	Vocabulary	.579
Arithmetic	.174	Arithmetic	.554
Vocabulary	.247	Picture Completion	.502
Picture Completion	.213	Block Design	.500
Picture Arrangement	.268	Similarities	.379
Block Design	.556	Object Assembly	.311
Object Assembly	-.055	Picture Arrangement	.209
Eigenvalue .746		Wilks' Lambda .573	

Table 16. *Caucasians: Discriminant Function Coefficients for the Identification of Giftedness*

Standardized Coefficients		Pooled Correlations Between Subtests and the Discriminant Function	
Information	.202	Object Assembly	.480
Similarities	.289	Vocabulary	.453
Arithmetic	.294	Information	.436
Vocabulary	.324	Block Design	.419
Picture Completion	.337	Picture Completion	.392
Picture Arrangement	.227	Similarities	.392
Block Design	.313	Arithmetic	.386
Object Assembly	.417	Picture Arrangement	.331
Eigenvalue 1.310		Wilks' Lambda .433	

Table 17. *Filipinos: Discriminant Function Coefficients for the Identification of Giftedness*

Standardized Coefficients		Pooled Correlations Between Subtests and the Discriminant Function	
Information	.003	Picture Arrangement	.507
Similarities	.321	Vocabulary	.486
Arithmetic	.172	Similarities	.471
Vocabulary	.199	Block Design	.468
Picture Completion	.419	Object Assembly	.427
Picture Arrangement	.435	Picture Completion	.424
Block Design	.413	Information	.376
Object Assembly	.230	Arithmetic	.359

Eigenvalue 1.076 Wilks' Lambda .482

Table 18. *Hispanics: Discriminant Function Coefficients for the Identification of Giftedness*

Standardized Coefficients		Pooled Correlations Between Subtests and the Discriminant Function	
Information	.252	Similarities	.566
Similarities	.376	Vocabulary	.555
Arithmetic	.111	Information	.549
Vocabulary	.265	Object Assembly	.461
Picture Completion	.270	Block Design	.437
Picture Arrangement	.273	Picture Completion	.424
Block Design	.225	Picture Arrangement	.412
Object Assembly	.298	Arithmetic	.347

Eigenvalue 1.191 Wilks' Lambda .456

Hit rates, false positive and false negative rates for the use of these individual functions are summarized in Table 19.

Table 19. *Hit Rates, False Positives, and False Negatives for the Best Individual Discriminant Function Models*

Model	Hit Rate	False Positives	False Negatives
African-American	93.6	17.5	3.1
Asian	90.9	16.7	7.4
Caucasian	95.0	12.2	2.3
Filipino	93.6	7.1	6.2
Hispanic	93.8	7.6	5.6

* of those who were not gifted, the percent called "gifted"
** of those who were gifted, the percent called "nongifted" by the model

By using individual models and capitalizing on differences in pattern of strengths and weaknesses across ethnic groups, rates have been improved for some groups. Caucasians and Asians are still overrepresented, as now are African-Americans. Hispanics and Filipinos have nearly equal false positive and false negative rates. An important note is that the models used to obtain these rates are based on functions that are *weighted* sums of subtests, and not simple combinations of subtests providing easy cut-off scores. These are the best rates available, based on fairly complex linear combinations. Any combination of subtest cutoff scores used in actual practice would necessarily have lower success rates.

To investigate the possibility that discrimination of nongifted from gifted could be improved by grouping those with similar patterns of abilities, African-Americans and Caucasians were considered together in one discriminant model. Both groups had a tendency for higher VIQ than PIQ (see baserate study, above). However, Caucasians are traditionally overselected and African-Americans underselected. Results of the analysis are presented in Table 20.

Table 20. *Discriminant Function Coefficients for Groups whose VIQ Exceeds PIQ (African-Americans and Caucasians)*

Standardized Coefficients		Pooled Correlations Between Subtests and the Discriminant Function	
Information	.150	Object Assembly	.542
Similarities	.290	Vocabulary	.526
Arithmetic	.257	Information	.509
Vocabulary	.304	Similarities	.481
Picture Completion	.273	Block Design	.473
Picture Arrangement	.219	Arithmetic	.473
Block Design	.224	Picture Completion	.433
Object Assembly	.349	Picture Arrangement	.407

Eigenvalue .8867 Wilks' Lambda .530

Using this discriminant model, overall hit rates have gone down to 80.6% for African-Americans and 90.1 for Caucasians. The misses, as expected, favor Caucasians (34.7% false positives, .5% false negatives) and again disadvantage African-Americans (0 false positives, 19.4% false negatives). No manipulation will improve the rates from the best individual ethnic group discriminant models, obtained using all available subtests.

One might be tempted to argue that identification could be improved and gifted programs could be ethnically balanced more economically by choosing each group's strongest subtest and basing the decision on a cutoff score applied to a different subtest for each group. For example, as was seen in Table 10, African-Americans' highest mean scaled score was Information, Asians' was Block Design, and so on. Only 24.5% of African-Americans scored below 12 on Information and only 25% of Asians scored below 15 on Block Design. Therefore the same cutoff score would not work in both groups on the individually selected subtests.

In similar fashion, it might be proposed that there exists one subtest that, at a given cutoff score, would select a balanced population. Not only does that prove not to be the case, but a more fundamental issue is involved in this and in the proposal to use a different subtest for each group. The basic argument for using the WISC-R as a selection tool for intellectually gifted enrichment programs is that it in some way measures a broad array of abilities associated with achievement in school. By narrowing the test down, even to four subtests (much less one or two), the predictive power of the test is greatly diminished.

Thus we see that no single selection model using the WISC-R will result in an ethnically balanced sample of gifted children from this population. In fact, the most accurate and most complicated individual models for ethnic subgroups are not uniformly accurate either. There appears to be no way to use the WISC-R to derive cut-off inclusion/exclusion scores in this ethnically diverse sample for use in selecting balanced populations for gifted programs in the schools.

IV. Discussion

Intellectually gifted children show differences in the pattern of their strengths and weaknesses on the WISC-R, across ethnic background and across levels of risk in the environment. In the first phase of this work, an analysis of base rates of VIQ-PIQ differences in 5796 children with FSIQ scores at least two standard deviations above the mean (FSIQ $\geq$ 130) revealed that African-Americans and Caucasians tended to have a higher VIQ than PIQ, whereas in Filipino children the tendency was the reverse. These trends, evident in group data, were confirmed in frequency distributions of individual difference scores. The distributions of VIQ-PIQ difference scores of Asians and Hispanics most closely resembled those obtained by Matarrazzo (1984) from the standardization sample for the WAIS-R, and most closely approximated normal distributions.

Groups divided on the basis of level of risk from factors such as significant health problems, economic hardship, emotional deprivation, or cultural and linguistic factors were also found to differ in pattern of strengths and weaknesses. Such hardships proved to be consistently associated with lower VIQ relative to PIQ in the individual. It can be surmised that, of all children at risk from two or more of these factors, this sample contained only the most invulnerable children—only the children still able to achieve a Full Scale score two standard deviations above the mean—and that in a randomly selected population across IQ ranges, the differences would be more extreme. Comparison of the relatively low proportion of high-risk children seen in the gifted base rate sample, as opposed to the entire sample of children referred for giftedness assessment, appears to corroborate that hypothesis (refer to Figures 1 and 2).

The myth that relatively large VIQ-PIQ discrepancies are somehow a diagnostic indicator for learning difficulties, such as low achievement relative to potential, was debunked in this sample. Groups of gifted children at the extremes of achievement (all achievement scores in the ninth stanine versus all achievement scores in the sixth stanine or lower) were compared and found to have equivalent ranges of VIQ-PIQ difference scores.

In the second phase of the work, an ethnically proportionately balanced sample of 1438 potentially gifted children was randomly selected. From that sample, selection models were derived and examined for goodness of fit in an effort to find a way to use the WISC-R to select a balanced population for educational enrichment programs. Alternative hypotheses that 1) there exists a single pattern of subtest scores that predicts giftedness equally across ethnic background, or 2) there is a unique pattern of cognitive strengths and thus different predictors of giftedness across groups, were investigated. The best single model obtained by discriminant analysis appeared accurate overall. When examined in terms of individual ethnic groups, however, it proved to be biased in favor of Caucasians and Asians, and biased against African-Americans and Filipinos. As was seen in the base rate study, different patterns of strengths were evident across groups. Even accounting for those differences with individual best-fitting models, efforts to improve selection balance failed. The very best individual models overselected African-American, Asian, and Caucasian children. **No way was found to use the WISC-R to select a proportionately balanced population.** If individual subtests or combinations of two or more subtests are used, as is suggested by some authors (Dirks, Wessels, Quarforth, & Quenon, 1980; Elman, Blixt, & Sawicki, 1981; Karnes & Brown, 1981; Kaufman, 1979; Killian & Hughes, 1978; Sattler, 1988), discriminability suffers. Perhaps more importantly, predictive power of the WISC-R is decreased.

The present results confirm the findings of differences in pattern of WISC-R performances between ethnic groups reported by Saccuzzo et al. (1992). Moreover, for the first time, base rates for

VIQ-PIQ difference scores are presented for a large, ethnically diverse sample of gifted children. The distributions of VIQ-PIQ difference scores were found to be substantively different in shape as well as in direction across ethnic groups, in contrast to the report that discrepancy scores "did not vary too greatly with ... race" at any level of IQ in the standardization sample of the WISC-R (Kaufman, 1976). In fact, statistical power was too low for identification of differences had they existed in the higher end of IQ scores in the standardization sample. Also for the first time, high levels of risk in a child's social and home environment have been shown in the present work to be associated with lower VIQ relative to PIQ in children in the upper end of the IQ distribution. **Moreover, the influence of risk factors appears to confer a disadvantage over and above any effect of ethnic background.**

No model was found to enable the WISC-R to be used to select equal proportions of gifted children from a variety of ethnic backgrounds. Therefore, in an ethnically diverse population, it would seem that Sattler (1988) is correct in saying that children who are culturally different are difficult to identify. The results of commonly used identification practices can be seen nationwide in the over-representation of Asians and Caucasians, as well as the under-representation of African-Americans and Hispanics. **The results of this study strongly suggest that use of the WISC-R in diverse populations as the primary selection device for gifted programs is an inappropriate use of the test, if one of the goals of such use is to select proportionately representative numbers from each group.**

Uniformity assumption myths abound in psychological assessment. Sattler (1988) presented cogent arguments in favor of national norms and against the idea of pluralistic norms. He pointed out, in part, that the WISC-R was standardized on a carefully stratified sample with ethnic minorities represented in proportion to their representation in the population. That is certainly true on a national level, but the appropriateness of using national norms so derived to define cut-off scores in a population which is predominantly non-Caucasian, as is this school district, is questionable. Normative scores are derived based on factors known to affect test performance: the WISC-R manual provides only age-corrected norms. **The current study has demonstrated that differences in test performance on the WISC-R exist across ethnic background and across gender.** In the past, the major psychological and educational assessment devices have been standardized primarily in terms of age or education, and sometimes gender. More recently, authors have stressed the importance of differences and the need for sets of norms that consider multiple factors such as gender, age, and education concurrently (Heaton et al., 1986), especially when these scores are used for clinical decision-making. Use of the WISC-R for selection of individual children for enrichment programs is, in essence, a clinical decision-making process. The idea of pluralistic norms based on ethnic background, however, is politically an extremely sensitive issue. Perhaps the clearest conclusion from the findings of the present work is that the test, with existing norms, produces scores that are certainly more appropriate for some groups of children than for others.

If "intelligence" or "intellectual giftedness" were to be defined as exactly those abilities underlying the quality of an individual's performance on the WISC-R, then we would have to conclude that the WISC-R is the best instrument to use for selection, regardless of any socio-political considerations such as the need for ethnic, socioeconomic, or even gender balance. However, we are dealing with a theoretical construct (intelligence) imperfectly measured by the WISC-R within a known error of measurement. This work has demonstrated that groups divided either on ethnic background or on environmental factors differ in the pattern of their performances on the WISC-R. The results do not and can not address the issue of how much of the individual and group differences are a result of biologic (presumably neural) differences or of environmental influences. Aside from the social and political implications of the use of the WISC-R as an entry criterion in diverse populations, the results of the present work indicate that the basic assumption of uniformity of pattern of performance across groups on the WISC-R is flawed. For whatever reason, be it biologic, environmental, or a combination of the two, pattern of performance across groups is not uniform.

Instead of attempting to find a way to continue to use the WISC-R in gifted selection models, it may behoove educators to adopt the use of multiple test instruments, including a nonverbal instrument such as Raven's Progressive Matrices (Raven, 1938) plus a measure of verbal reasoning ability as well as behavioral and motivational indicators. In any case, inclusion/exclusion decisions should never be

based on a single test score, just as no clinical decision should be solely based on any one score or even on one test.

The studies reported here are limited by the same factors inherent in any quasi-experimental design as well as by the limitations of archival and cross-sectional research. Attempts were made to control for gender and to examine ethnic and risk level effects. It should be pointed out, however, that the original sample from which subsamples were drawn was not a random, multivariate normal sample from the entire population. Instead, this was a sample of children referred by parents, teachers, and central nomination for assessment because each had in some way demonstrated the potential for intellectual giftedness. Almost certainly biases were inherent in that referral process. One of those biases can be seen in the unequal proportions of children from different ethnic backgrounds. Another concerns the under-representation of WISC-R scores from Hispanic children who have English as a second language, and are often tested with other assessment devices.

Self-report questionnaires are a source of error from both under-reporting and over-reporting. Ethnic background was deduced by response of the primary caregiver to a school district questionnaire, and incidence of risk was gathered from information questionnaires provided by teachers and by parents. For example, a child who is 10% Native American may be reported as Native American, while one who is Hispanic/Caucasian may be reported as Caucasian because of beliefs the parents hold about the implications for their child of certain ethnic designations within the education system. The risk factors examined in this work are almost certainly an under-representation of population incidence. Those at risk may have been under-reported both by teachers who have have less contact with particular groups of parents, and by the parents who are overwhelmed by the same environmental stressors that affect their children. It is likely that the more seriously economically and environmentally disadvantaged have less access to health care and may also mistrust an educational establishment that doesn't seem to be addressing their most pressing needs. On the other hand, affluent parents may over-report certain risk factors, such as health problems and emotional problems.

There could be other areas of risk not included in the risk factor questionnaires used by this district. For example, acculturation issues are complex and are not well investigated in these questionnaires. Other than the self-report of cultural differences in the home (in the student-parent questionnaire, Appendix C), no attempt could be made to divide groups on the basis of acculturation, since we did not have access to detailed structured interviews. Lastly, ethnic categories were broad and included diverse groups within some single categories. For example, the one category "Hispanic" included Latinos, Cubans, Puerto Ricans, and Hispanics. The group "Asians" included children of Japanese and Chinese background. It may be that more differences exist within these heterogeneous groups than across our ethnic categories.

In terms of the test data itself, some subtest scores were frequently missing from the data since the school district, due to time and financial constraints, does not routinely administer all of the subtests of the WISC-R. Therefore Coding, Mazes, Comprehension, and Digit Span could not be included in the multivariate modeling phase of the study. It may be possible to find more accurate selection models with the WISC-R if those subtests are included.

Finally, the sample was drawn entirely from the San Diego area. Results may not generalize to other geographic areas: San Diego is a metropolitan area with a preponderance of Latinos in its Hispanic population and a significant proportion of first and second generation Asians in its Asian population. As noted above, the majority of the students in the district are non-Caucasian.

On the other hand, the sample reported here is derived from an ethnically diverse district that has consistently shown a commitment to identification of disadvantaged students for gifted programs. The sample does consist of the entire population of children referred and subsequently administered the WISC-R as part of the selection process for gifted education programs. The number of non-Caucasian children, particularly in the gifted base rate sample, is larger and more diverse than any previously reported. Moreover, a completely balanced sample of 1438 was randomly selected from an overall

sample of 8396. Lastly, if risk factors were indeed under-reported and ethnic groups were heterogeneous, the likelihood of finding clear differences between groups would be decreased. Nevertheless, differences were found.

This work has demonstrated clear differences in pattern of abilities across ethnic backgrounds and across levels of risk in the children's environment. Population rates of VIQ-PIQ discrepancies have been documented, and the importance of the difference between statistical significance and clinical rarity across ethnic groups has been illustrated. No single model using the WISC-R was found to provide proportionately equal access to gifted programs. Individual models based on ethnic background failed to achieve ethnic balance, since individual models over-selected African-Americans, Asians, and Caucasians relative to Filipinos and Hispanics. Therefore, **use of the WISC-R in a diverse population to select a balanced group was demonstrated to be inappropriate**.

Other instruments, such as Raven's Progressive Matrices, need to be tested in such a large, multicultural population, as has been repeatedly recommended (Baska, 1986; Pearce, 1983; Valencia, 1984). Some combination of assessment devices that account for motivation as well as intellectual potential may need to be evaluated. Given that we find a way to identify greater proportions of disadvantaged children with high potential, the focus then must turn to finding ways to ensure that these "different" children express that potential. The children we identify with alternative methods may not be the verbally gifted, behaviorally compliant children who currently populate the gifted classrooms in this district. Further work will need to focus on changes in the enrichment programs themselves, to enable teachers of the gifted to unlock and direct the potential these children demonstrate. Improved identification is certainly a goal that needs to be met, but it will be an empty victory if it is achieved and the children so identified fail to be able to express that potential in ways that add to their own growth as well as the growth of their cultures and societies.

There is a dearth of data on how best to nurture particular kinds of talents: that lack of research-based knowledge, combined with administrative inflexibility in the use of resources (particularly in a climate of increasing budget constraints), bodes poorly for children whose giftedness is expressed not so much in verbal domains as in other intellectual areas. We have seen from the experience at Berkeley and other universities (D'Souza, 1991) the disturbing outcome of including individuals who would not have qualified based on established, traditional, uniform criteria into a system which does not change to fit their needs. Dropout rates are high, and we do not know the long-term negative effects of the experience for those who are not able to complete the program. Future studies are needed to examine ways to develop effective educational programs for diverse classes of very young gifted children, and longitudinal studies will be necessary to evaluate the effectiveness of the interventions so developed. Understanding of motivational principles, group process, and cultural as well as individual differences in achievement needs and in pattern of abilities is vital for the development of interventions to provide mastery experiences for these children early in the educational process. Only then can we provide more effective strategies for engaging these children in the life-long growth and development of the potential they as individuals possess.

Appendix A.

San Diego City Schools
Educational Services Division
Gifted and Talented Education

Teacher Nomination Form

Date_____

Student Name_____ Birth Date_____ Sex___ Ethnic Code___
(last) (first) (mi)

School_____ Grade_____ Room Number_____

GUIDE FOR IDENTIFICATION OF PROSPECTIVE GATE CHILDREN

Please rate (name)_____ on each of the following characteristics. This is a five-point scale with the lower end of the scale (#1) indicating lower than average performance and the upper end (#5) indicating excellent or exemplary performance.

	1	2	3	4	5
I. PERSONAL					
1. Curious; asks many questions	___	___	___	___	___
2. Self-motivated; requires little external direction or encouragement	___	___	___	___	___
3. Likes to organize people and structure activities	___	___	___	___	___
4. Generates many ideas, questions, and suggestions	___	___	___	___	___
5. Flexible; adapts readily to new situations	___	___	___	___	___
6. Impatient with routine tasks	___	___	___	___	___
II. EXPRESSION					
7. Vocabulary beyond chronological age or grade level	___	___	___	___	___
8. Advanced skill in written expression	___	___	___	___	___
9. Proficiency in oral expression	___	___	___	___	___
III. THOUGHT PROCESSES					
10. Quick and accurate recall of factual information	___	___	___	___	___
11. A storehouse of information on a variety of topics	___	___	___	___	___
12. Readily recalls visual information	___	___	___	___	___
13. Readily recalls auditory information	___	___	___	___	___
14. Generalizes learning from one experience to another	___	___	___	___	___
15. Finds differences and similarities in events	___	___	___	___	___
16. Understands concepts without extensive concrete examples	___	___	___	___	___
17. Can establish relationships between seemingly unrelated concepts and ideas	___	___	___	___	___
18. Is insightful about cause and effect relationships	___	___	___	___	___

GUIDE FOR IDENTIFICATION OF PROSPECTIVE GATE CHILDREN

Page 2

IV. PRODUCTION AND OUTPUT	1	2	3	4	5
19. Displays a great deal of imagination	___	___	___	___	___
20. Manipulates ideas (i.e., makes changes and elaborates upon them)	___	___	___	___	___
21. Concerned with improving or adapting objects and systems	___	___	___	___	___
22. Capable of intense concentration on tasks of interest to her/him	___	___	___	___	___
23. Does not give up easily when confronted with a challenge; shows determination in achieving goals	___	___	___	___	___
24. Offers unique, clever responses to questions	___	___	___	___	___
25. Resourceful, knows where to find answers	___	___	___	___	___
V. ACHIEVEMENT					
26. High performance (grades) in a particular subject, e.g., math, language arts, science, other_____	___	___	___	___	___
27. Achieves at a high educational level	___	___	___	___	___
VI. LEADERSHIP					
28. Has strong communication skills; gets ideas across effectively	___	___	___	___	___
29. Assumes leadership role easily	___	___	___	___	___
30. Facilitates and directs efforts	___	___	___	___	___
VII. OTHER CHARACTERISTICS					
31. Dominates situations	___	___	___	___	___
32. Expressive of thoughts and opinions	___	___	___	___	___
33. Compulsive about work and work habits; strives for perfection	___	___	___	___	___
34. Becomes involved in task, loses awareness of time	___	___	___	___	___
35. Persistent in pursuing discussion beyond cutoff point	___	___	___	___	___
36. Appears inattentive, withdrawn (daydreams)	___	___	___	___	___

Prepared by_____ Recommended? Yes____ No____
(Teacher)

Reviewed by_____ Recommended? Yes____No____
(Administrator/Designee)

Appendix B.

San Diego City Schools
Educational Services Division
Gifted and Talented Education

TEACHER NOMINATION FORM

Date_____

Name_____ Birth Date_____ Sex_____Ethnic Code_____

School_____ Grade____Track _____Room Number_____

SOCIAL/ENVIRONMENTAL VARIABLES

Please check all items that apply:

1. ENVIRONMENTAL
   - _____ Lacks preschool/kindergarten experience
   - _____ Irregular attendance
   - _____ Transiency (3 or more school moves)
   - _____ Limited home enrichment opportunities (availability of books, periodicals, family interaction, family outings)
   - _____ Home conflicts:
     - _____ Responsibilities and study time
     - _____ Excessive child care responsibility
     - _____ Working to help support family
     - _____ Overcrowding — no study area
     - _____ Inconsistencies in the home
2. ECONOMIC
   - _____ Economic hardship
   - _____ Single parent head of household
   - _____ Unemployment
3. LANGUAGE
   - _____ Primary language of parent and/or student is other than English
   - _____ Not proficient/fluent in English
   - _____ Uses non-standard English
   - _____ Student enrolled in Second Language Immersion Magnet (SLIM)
4. CULTURAL
   - _____ Limited home/school communication
   - _____ Experience in dominant culture is limited
   - _____ Cultural values and beliefs differ from dominant culture

SOCIAL/ENVIRONMENTAL VARIABLES

Page 2

5. SOCIAL/EMOTIONAL

_____ Child abuse: physical_____ mental_____ neglect_____

_____ Emotional/adjustment problems

- _____ Working with district counselor
- _____ Working with social worker
- _____ Utilizing psychological services
- _____ Other:_____

_____ Significant home factors

- _____ Separation
- _____ Divorce
- _____ Death

_____ Extended absence of parent

- _____ Military
- _____ Employment
- _____ Other:_____

_____ Family

- _____ Single parent
- _____ Remarriage/step-parent

6. HEALTH

_____ Designated instructional services

- _____ PHDIS
- _____ Speech and language
- _____ Vision
- _____ Hearing
- _____ Adaptive P.E.

_____ Severe allergies

_____ Asthma

_____ Frequent medical/health referral

_____ Regularly prescribed medication

_____ Other:_____

Prepared by_____ Recommended? Yes_____ No_____

(Teacher)

Reviewed by_____ Recommended? Yes_____No_____

Appendix C

San Diego City Schools
School Services Division
Gifted and Talented Education

STUDENT/PARENT INFORMATION FORM

Student Name: Date_____

_____Birth Date_____Sex___School_____
(Last) (First) (mi)

Address_____Mother's name_____Occupation_____
(Street) Work Phone_____

_____Father's name_____Occupation_____
(City) (State) (Zip) Work Phone_____

Grade_____ Room Number_____ Track_____ Home Phone_____

Schools Attended Grade Dates Attended

_____

_____

_____

1. Names and ages of brothers and sisters:_____

_____

2. Describe your child's attitude toward school:_____

_____

3. List any special interests, talents, and skills your child may have:_____

_____

4. What special lessons, training or learning opportunities has your child had outside of school?

_____

_____

5. To help us know more about your child, please check any of the following that apply:

- ❑ allergies
- ❑ asthma
- ❑ frequent absences
- ❑ prescribed medications
- ❑ parent in military
- ❑ frequent parent absence
- ❑ parents separated
- ❑ single parent
- ❑ remarriage/step-parent
- ❑ recent death/significant illness in family
- ❑ 3 or more schools attended
- ❑ no kindergarten or pre-school experience
- ❑ additional language(s) spoken in home
  List:_____

6. Has your child been previously assessed? ❑ yes ❑ no If yes, when?_____

7. What other things would you like us to know that would assist us in assessing your child?

_____

_____

Name of person completing this form_____ Relationship to student_____

CHAPTER 3

Evaluation of Risk Factors in Selecting Children for Gifted Programs

---

Part 1: Gifted Children at Risk: Evidence of an Association between Low Test Scores and Risk Factors

Nancy E. Johnson, Dennis P. Saccuzzo, & Tracey L. Guertin
San Diego State University

Part 2: Intelligence, Aptitude, and Achievement in Gifted Children With and Without Language Risk

Tracey L. Guertin, Nancy E. Johnson, & Dennis P. Saccuzzo
San Diego State University

* This research was funded by Grant R206A00569, U.S. Department of Education, Jacob Javits Gifted and Talented Discretionary Grant.

The authors express their appreciation to the San Diego City Schools, to Gifted and Talented Education (GATE) Administrator David Hermanson, and to the following school psychologists: Will Boggess, Marcia Dorne, Eva Jarosz, Dimaris Michalek, Lorraine Rouse, Ben Sy, and Daniel Williams.

Correspondence concerning these article should be addressed to Dennis P. Saccuzzo, Joint San Diego State/University of California, San Diego Clinical Training Program, 6363 Alvarado Court, Suite 103, San Diego, California 92120-4913.

© 1994
Do not reproduce in any form without express written permission from the authors.

Part 1:

Gifted Children at Risk: Evidence of an Association between Low Test Scores and Risk Factors

Nancy E. Johnson, Dennis P. Saccuzzo, & Tracey L. Guertin

San Diego State University

This research was funded by Grant R206A00569, U.S. Department of Education, Jacob Javits Gifted and Talented Discretionary Grant Program.

The authors express their appreciation to the San Diego Unified City Schools, to Gifted and Talented Education (GATE) Administrator David P. Hermanson, and to the following school psychologists: Will Boggess, Marcia Dijiosia, Dimaris Michalek, Ben Sy, and Daniel Williams.

Correspondence should be addressed to Nancy E. Johnson, JSan Diego State University, 6363 Alvarado Court, Suite 103, San Diego, California 92120-4913 (Telephone: 619-594-2845 / FAX: 619-594-6780 / e-mail: njohnson@psychology.sdsu.edu).

©1994
Do not reproduce in any form without express written permission from the authors.

Abstract

Intellectually gifted children from diverse ethnic and cultural backgrounds as well as varying levels of risk were evaluated to determine the effect of risk on gifted children when intelligence level has been controlled. Each of the 7,323 children from six ethnic backgrounds had achieved a standardized intelligence test score (Wechsler Intelligences Scale for Children - Revised or Raven's Standard Progressive Matrices) at least two standard deviations above the mean. Six areas of risk evaluated in a case study approach included cultural, economic, emotional, environmental, health and language factors. Although each child in the sample had demonstrated high intellectual potential, differences were found between groups defined on level of risk: no risk, low risk (one and only one area of risk), and high risk (more than one area of risk). High risk gifted children were found to be disadvantaged relative to those at low or no risk in all measures of both aptitude and achievement, as assessed with the Developing Cognitive Abilities Test and the Comprehensive Test of Basic Skills. Furthermore, those at high risk demonstrated lower WISC-R Verbal IQ scores than children at lower levels of risk. Implications and limitations of these findings for assessment of giftedness, identification of potential gifted underachievers, and development of gifted curriculum are discussed.

Gifted Children at Risk: Evidence of an Association between Low Test Scores and Risk Factors

Since the 1960's, much has been written about gifted children at risk. One focus of this literature is the failure to identify gifted children at risk, presumably because of the use of standardized tests as criterion measures. Criticism has repeatedly been leveled at the use of standardized tests in any child considered to be at risk because of ethnic or cultural background (Cronbach, 1984; Sullivan, 1973; Sattler, 1982), socioeconomic disadvantage (Fetterman, 1986; Harty, Adkins, & Sherwood, 1984; Shaw, 1986), health or handicapping condition (Pledgie, 1982), or differences in language (Sattler, 1982). Other investigators have noted the difficulty in the identification of giftedness in children with these risk factors (Albrecht & Rost, 1983; Bruch, 1971; Harty, et al., 1984). However, less attention has been given to children who, despite risk factors, perform at high levels on standardized tests of intellectual potential and so are recognized gifted. Passow (1989) suggested that priority areas of research in the education of high-ability children should include not only the need to identify and nurture giftedness in "disadvantaged" populations, but also explication of what is needed to transform potential into performance in the gifted. We hypothesize that intellectually gifted children at risk show patterns of disadvantage on tests of potential and achievement when compared to intellectually gifted children not at risk, and submit that these patterns may prove useful in the development of educational programs designed to unlock potential in gifted children at risk.

Several factors have been shown to be associated with underachievement in children. Included in emotional factors are such stresses as parental conflict due to the absence of a parent, or child maltreatment. Zilli (1971) found that underachievers tend to come from broken homes. Wallerstein (1985) found that children from single parent homes have a higher rate of absenteeism as well as lower academic competence at school entry, and suggested that they may be burdened by too much responsibility for care of themselves and of younger siblings. However, the effects of emotional factors may be confounded with the effects of socioeconomic status, particularly in single-parent homes.

Low socioeconomic status has consistently been found to correlate negatively with identification for gifted programs (Fetterman, 1986; Harty, et al., 1984; Shaklee, 1992; Shaw, 1986). A 1983 (Albrecht & Rost) survey of San Diego gifted and talented classrooms using zip code as an indicator of socioeconomic status revealed that children from neighborhoods with higher housing prices were more likely to be identified gifted and to participate in gifted and talented programs. Pirozzo (1982) pointed out that socioeconomic status is a major difference between potentially gifted underachievers and gifted children whose achievement matches their potential. One weakness of many studies that attempt to look at socioeconomic status is that socioeconomic status is often confounded with ethnic or cultural background, and with poor health.

Nichols and Anderson (1973) attempted to control for differences in socioeconomic status between African-American and White 7-year-old children to yield a clearer indication of ethnic differences between these two groups by matching on SES, geographic location, and provision of prenatal care. These authors found that differences in IQ were reduced to approximately five points, in favor of White children, rather than the 15-point advantage often cited. In contrast to the approach of most investigators to examine deficits, Bruch (1971) reported the intellectual strengths found in intelligence test performance in gifted African-American children in the southeast. These strengths included practical problem-solving, memory operations, and visual and auditory figural content.

It has been well documented that low socioeconomic status affects the health of children and their mothers. African-Americans, in particular, have a higher rate of premature birth and abnormalities in pregnancy than do Whites (Wiener & Milton, 1970). Because of multiple risk factors in their environments, migrant children and homeless children are characteristic of those described by Haney (1963) as, "The most educationally deprived group of children in the Nation" (p. 101). Given the inconsistencies in their educational experience as well as the demands placed on them to care for their siblings, it seems unlikely that the potential of such gifted children could be fully expressed (Frasier, 1979 & 1982). As Laslow & Nelson (1974) pointed out, cultural differences, emotional problems, and physical disabilities are more likely to occur in children from lower socioeconomic households.

The present study attempted to examine a range of identified risk factors as well as level of risk for children who attained standardized intelligence test scores that were at least two standard deviations above the mean. Therefore, despite varying levels of risk, each of these children had demonstrated high academic potential and had been identified intellectually gifted. The sample was selected from a large, diverse sample of children who had been referred and evaluated for giftedness. Six areas of risk were examined: cultural, economic, emotional, environmental, health, and language. Cultural risk included cultural values and beliefs that differ from those of the dominant culture, or limited experience in the dominant culture. Economic risk included parental unemployment or low household income. Emotional risk encompassed such factors as death of a parent or sibling, child abuse, psychiatric illness in the nuclear family, or extended parental absences due to military service. Environmental risk included transiency (three or more school moves) and excessive absences from school that were due to specific factors not related to another risk factor (e.g., absences due to home responsibilities such as child care or working to help support the family). Health risk included vision, speech, or hearing deficits requiring designated instructional service, motor problems requiring adaptive physical education, or chronic diseases such as asthma. Language risk included English as a second language or lack of fluency in English.

For the purposes of this study, three levels of risk were defined. Children at no risk were those who had no identified risk factors. Those at low risk were children who had identified risk in one of the six areas previously described. High risk children were those who had been identified as having risk in at least two of the areas defined. For the purposes of this study, level of risk was defined by number of areas of risk, rather than by absolute numbers of individual risk variables within the areas. For example, a child who had asthma as well as a hearing deficit would, by definition, be at low risk since both risk factors fall in the one area of health risk.

Since these risk areas have been shown to be associated with lower achievement in children, we hypothesized that, even among children identified intellectually gifted based on intelligence test scores, differences would be found in aptitude and achievement test scores as a function of level of risk in the child's background.

Method

Subjects

The sample was drawn from the 11,074 children who had been referred for giftedness testing in the San Diego City School System between 1984 and 1991. Of these referred children, 1,107 were Latino/Hispanic; 7,751 were White; 855 were African-American; 393 were Asian; 390 were Indochinese; and 578 were Filipino. Fifty-one percent were male. The majority of the children were in the second (4,276), third (2,473), or fourth (1,248) grade. The remainder were in the first (187), fifth (993), sixth (962), seventh (392), eight (276), or ninth (192) grade. Information on grade level was not available for 75 children.

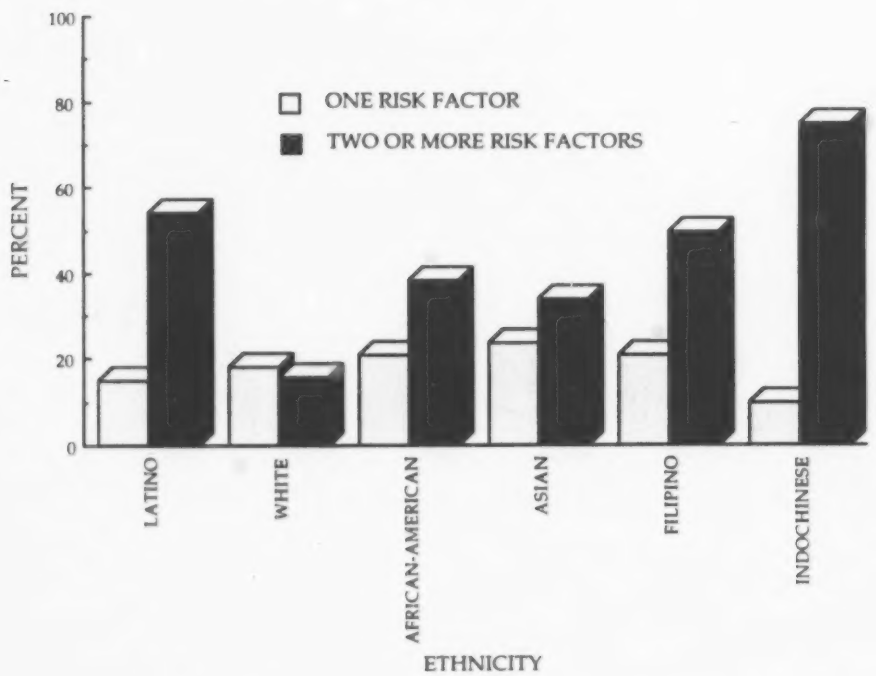
For the purposes of this study, a sample of all children who achieved a WISC-R Full Scale IQ score of at least 130 or a Raven IQ equivalent of 130 was selected. Thus, we isolated the group of high IQ scoring children. A total of 7,323 children met this criterion. Of these, 464 were Latino/Hispanic, 5750 White, 366 African-American, 279 Asian, 303 Filipino, and 161 Indochinese. Fifty-four percent were male.

Procedure

Each subject was referred for giftedness testing by a parent or teacher, or through central nomination of high-achieving children. Each was then either individually tested with the Wechsler Intelligence Scale for Children - Revised (WISC-R) or group tested with the Raven Standard Progressive Matrices Test, and group tested with the Developing Cognitive Abilities Test (DCAT). The DCAT, an aptitude test designed to predict academic achievement, provides estimates of potential for verbal, quantitative, and spatial abilities. Reliability coefficients for the composite score are in the low .90's,

while those for the verbal, quantitative, and spatial scores range from the mid .70's to the mid .80's. The WISC-R or Raven and DCAT were used in conjunction with the child's scores on the Comprehensive Test of Basic Skills (CTBS), a standardized achievement test. A school psychologist then conducted a case study analysis of each child and determined, through a self-report questionnaire sent to the home and to the child's teacher, whether the child had any one of six risk factors: language, cultural, economic, emotional, health, and environmental. In the high IQ sample, 4,303 children had no identified risk factors; 1,340 had one; and 1,680 had more than one. The distribution of level of risk varied across ethnic background. Figure 1 illustrates the percentage of children at risk (one risk factor versus more than one) for each ethnic group. The majority of white children had no identified risk factors, whereas the majority of Latino, African-American, Asian, Filipino, and Indochinese children had at least one. Seventy-five percent of Indochinese children had two or more risk factors, placing them at high risk for failure to achieve their potential.

Figure 1. Percentage at each positive level of risk (one risk factor versus two or more) for each ethnic background.



Results

Table 1 shows the correlation among the various risk factors. Due to the large number of subjects, most correlations are statistically significant. Notably high correlations were found between Cultural and Language risk, Economic and Environmental risk, Economic and Emotional risk, and Emotional and Environmental risk.

Table 1
Risk factor correlations (Pearson r)

	Cultural	Economic	Emotional	Environmental	Health	Language
Cultural	1.00	.21**	.05**	.18**	-.02*	.61**
Economic		1.00	.40**	.30**	.08**	.15**
Emotional			1.00	.30**	.16**	.05**
Environmental				1.00	.09**	.15**
Health					1.00	-.01
Language						1.00

* $p < .05$
** $p < .01$

For all subsequent analyses, Level of Risk has been defined as No (no risk factors), Low (one risk factor, and High (more than one risk factor).

For those children who had been given the WISC-R, data were analyzed in a 3 (Risk Level: No, Low, High) X 2 (IQ Score: Verbal, Performance) mixed repeated measures ANOVA with repeated measures on IQ score. Significant main effects were found for Risk Level, $F_{(2, 5881)} = 3.21$, $p < .05$, and for IQ Score $F_{(1, 5881)} = 292.65$, $p < .001$. There was also a significant Risk Level by IQ Score interaction $F_{(2, 5881)} = 11.21$, $p < .001$. Given the number of subjects, observed power at the .001 level ranged from .992 to 1.000. Table 2 shows the means and standard deviations for the WISC-R data.

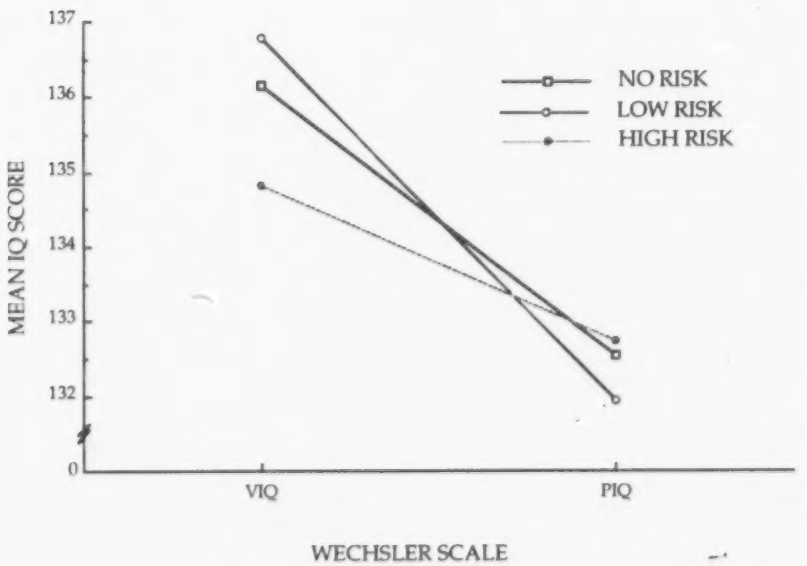
Table 2

WISC-R IQ scores: descriptive statistics for three levels of risk.

	No Risk (n= 3964)		Low Risk (n = 974)		High Risk (n = 946)		Marginals (n = 5884)	
	M	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
VIQ	136.15	(8.63)	136.78	(8.87)	134.83	(9.10)	136.04	(8.76)
PIQ	132.55	(9.05)	131.95	(9.21)	132.75	(9.34)	132.48	(9.12)
Marginals	134.15	(8.84)	134.65	(9.04)	133.79	(9.22)		

The significant interaction revealed that high risk children were particularly impaired in Verbal IQ. Post-hoc Newman-Keuls comparisons revealed that high risk children had significantly ($p < .05$) lower VIQ than no risk and low risk children, and that low risk children had higher VIQ than those with no risk at all. No significant differences were found in PIQ. For ease of interpretation, the interaction is displayed in Figure 2.

Figure 2. The interaction between level of risk and WISC-R IQ.



To examine the relationship between risk and specific Wechsler subtests, the data were analyzed in a 3 (Risk Level) X 8 (Subtest) mixed repeated measures ANOVA with repeated measures on the subtest scores. These analyses were based on the eight subtests routinely administered by the GATE department in this district (see Table 3).

Table 3

WISC-R subtest scores: descriptive statistics for three levels of risk.

Subtest	Entire Sample (n=5611)	No Risk (n=3804)	Low Risk (n=917)	High Risk (n=890)
Information	14.63 (2.10)	14.70 (2.08)	14.67 (2.08)	14.34 (2.19)
Similarities	16.76 (2.03)	16.75 (2.02)	16.91 (2.01)	16.63 (2.08)
Arithmetic	14.88 (2.19)	14.89 (2.20)	14.85 (2.23)	14.85 (2.10)
Vocabulary	15.78 (2.19)	15.83 (2.13)	15.94 (2.20)	15.39 (2.35)
Picture Completion	13.97 (2.21)	13.90 (2.21)	14.02 (2.19)	14.17 (2.21)
Picture Arrangement	14.85 (2.55)	14.90 (2.55)	14.82 (2.52)	14.65 (2.53)
Block Design	15.26 (2.51)	15.32 (2.49)	15.02 (2.55)	15.26 (2.56)
Object Assembly	14.51 (2.55)	14.59 (2.54)	14.36 (2.52)	14.33 (2.56)

There was a significant main effect for Risk Level, $F(2,5608) = 70.47$, $p < .001$, as well as a significant Subtest effect, $F(7, 39256) = 555.00$, $p < .001$. In general, children at high risk had lower scores than those at no risk, and the highest scaled scores were in Similarities for all groups while the lowest were in Picture Completion. Also significant was the Risk Level X Subtest interaction, $F(14, 39256) = 5.91$, $p < .001$. Post-hoc Newman-Keuls analyses revealed that children at high risk were significantly ($p < .05$) disadvantaged in Information and Vocabulary relative to the other two risk levels. However, children at high risk had significantly ($p < .05$) higher scores than those at no risk on one subtest: Picture Completion. Other significant differences included lower scores for high risk children relative to low risk children on Similarities and relative to no risk children on Picture Arrangement. Although these differences are statistically significant, as can be seen in Table 3, they represent very small differences in scaled scores and should be interpreted with caution.

Percentile scores for the DCAT were converted to z-scores and then analyzed in a 3 (Risk Level) X 3 (DCAT Score: Verbal, Spatial, Quantitative) mixed repeated measures ANOVA with repeated measures on DCAT scores. There was a significant main effect for Risk Level, $F(2, 2592) = 44.47$, $p < .001$. This effect showed that children at high risk had lower scores, summed across the three subtests, than those at no or low risk. The significant main effect for DCAT score, $F(2, 5184) = 18.74$ $p < .001$ demonstrated that Verbal scores tended to be higher than Quantitative scores, which were higher than Spatial scores. The significant DCAT score by Risk Level interaction, $F(4, 5184) = 4.59$, $p < .001$, revealed that for those at high risk, Quantitative scores were highest, followed by Verbal and then Spatial scores, whereas for those at no or low risk Verbal scores were higher than Quantitative. Post-hoc Newman-Keuls comparisons demonstrated significant ($p < .05$) disadvantage for children at high risk relative to those at low and no risk in all three DCAT scores (see Table 4).

Table 4

DCAT scores: descriptive statistics for three levels of risk.

		Total (n=2595)	No Risk (n=987)	Low Risk (n=704)	High Risk (n=904)
Verbal:	percentile (*SD*)	85.58 (15.09)	87.85 (12.50)	87.49 (12.98)	81.61 (18.12)
	z-score (*SD*)	1.35 (0.76)	1.46 (0.72)	1.42 (0.71)	1.16 (0.81)
Quantitative:	percentile (*SD*)	84.99 (16.30)	86.02 (14.46)	85.97 (15.18)	83.09 (18.70)
	z-score (*SD*)	1.28 (0.74)	1.32 (0.69)	1.32 (0.71)	1.21 (0.80)
Spatial:	percentile (*SD*)	83.82 (17.46)	85.59 (15.18)	85.00 (16.27)	80.97 (20.13)
	z-score (*SD*)	1.23 (0.78)	1.31 (0.73)	1.28 (0.75)	1.10 (0.83)

Achievement scores, as measured by the CTBS, were analyzed in a 3 (Risk Level) X 3 (CTBS Score: Total Language, Total Reading, Total Math) mixed repeated measures ANOVA with repeated measures on the CTBS scores. Again, there was a significant main effect for Risk Level , $F(2, 1616) = 20.45$, $p < .001$. This result again showed that children at high risk achieved lower scores, summed across the three areas of achievement, than did those at low or no risk. There was also a significant main effect for CTBS score, $F(2, 3232) = 221.61$, $p < .001$, with significantly higher Total Math scores than Total Language, and significantly higher Total Language than Total Reading. The interaction of CTBS score and Risk Level, $F(4, 3232) = 2.81$, $p < .05$, indicated that children at low risk achieved scores equivalent to or lower than those at no risk in Total Reading and Total Math, but slightly higher than those at no risk in Total Language. Post-hoc Newman-Keuls comparisons revealed that those at high risk were again significantly ($p < .05$) disadvantaged relative to those at low or no risk . The disadvantage was apparent for all three CTBS scores (See Table 5).

Table 5

CTBS stanine scores: descriptive statistics for three levels of risk.

		Total (n=1619)	No Risk (n=662)	Low Risk (n=388)	High Risk (n=569)
Total Language	*M* (*SD*)	7.65 (1.14)	7.74 (1.07)	7.78 (1.06)	7.46 (1.24)
Total Reading	*M* (*SD*)	7.43 (1.19)	7.56 (1.06)	7.56 (1.16)	7.19 (1.31)
Total Math	*M* (*SD*)	8.16 (1.09)	8.22 (1.07)	8.20 (1.07)	8.07 (1.12)

Discussion

The present study compared intellectually gifted children at three levels of identified risk: no risk, low risk (one area of risk) and high risk (two or more areas of risk). These children were evaluated in six areas of risk: cultural, economic, emotional, environmental, health, and language. Every child in the study had been referred as potentially gifted and had subsequently achieved either a WISC-R Full Scale IQ score of at least 130, or a Raven Standard Progressive Matrices score at least two standard deviations above the mean. Therefore IQ was tightly controlled. Every child in the study had

demonstrated high intellectual potential despite the presence of varying levels of risk for failure to fully express that potential. This design allowed us to evaluate the effect of risk without confounding IQ.

The data support our hypothesis of a different pattern of scores in children at risk. This pattern is characterized by depressed verbal abilities. In general, children at high risk were found to be disadvantaged relative to those at low or no risk in all measures of both aptitude and achievement. Furthermore, those at high risk demonstrated lower WISC-R Verbal IQ than those at lower levels of risk. The disadvantage in Verbal IQ was particularly evident in the Information and Vocabulary subtests. Thus our findings support the hypothesis that high levels of risk negatively impact expression of a gifted child's intellectual potential.

These data are not surprising. Low scores on Information and Vocabulary have long been known to be associated with risk factors such as poor reading ability, environmental deprivation, and emotional problems (Guertin, Ladd, Frank, Rabin, & Hiesler, 1971; Lewandowski & Saccuzzo, 1976; Saccuzzo & Lewandowski, 1976). The present study is unique in showing that Information and Vocabulary are depressed even while IQ is controlled and even for intellectually gifted children.

The consistency of the low scores on Information and Vocabulary for children at risk across a variety of studies strongly points to the possible diagnostic significance of these subtests. Certainly, when evaluating for giftedness, practitioners should be alert to the presence of risk factors whenever these scores are depressed.

Other findings from the study should be interpreted more cautiously. The finding of relatively high scores on Picture Completion needs to be considered in light of the standards promulgated by Lewandowski & Saccuzzo (1976). As these investigators noted, in order for a specific test sign to have reliable diagnostic significance, a number of methodological standards must be met. These include control of all major relevant variables, sufficient power, and cross-validation.

The present study, while meeting the standards for control and power, did not include a cross-validation. Thus, before we accept the diagnostic significance of the Picture Completion subtest as a marker of risk, it would be important that the present findings be cross-validated on an independent sample.

From the standpoint of the education of children at risk, a number of factors should be considered. First, despite their high IQ's, these children have a relatively depressed vocabulary. Teachers of gifted children at risk might, therefore, concentrate on enriching the vocabularies of these children. The low score on the Information subtest may have several implications. It could be that these children do not have the same opportunity to acquire everyday factual information as do children not at risk. Alternatively, these children, due to such factors as economic disadvantage and environmental distress, do not have the same interest in acquiring factual information as do more advantaged children. It would seem important that teachers of the high risk gifted attempt to bring relevance to the educational process for these children.

The results show a surprisingly high concentration of risk for Latino, African-American, and Filipino children. Practically 80 percent of the Latino, 60 percent of the African-American, and 70 percent of the Filipino children had at least one risk factor. These findings reveal that individuals from these groups, even though gifted, have a high potential for risk. Even more surprising was the finding that nearly 80 percent Indochinese had two or more risk factors. Educators working with these populations need to be sensitized to the high level of adversity these children face. It should be emphasized that these children, in spite of their adversity, still managed to score two standard deviations above the mean on a standardized IQ test. Children within these groups who are not as intellectually capable clearly are far more vulnerable to the varieties of risk that they must deal with on a daily basis.

There were some important correlations among the various areas of risk. The strong association between cultural and language risk is not surprising. Children who come from nonEnglish-speaking

homes, more often than not, come from a different culture. Another important area of association was found among environmental, economic, and emotional risk. Although cause–effect relationships cannot be discerned from these data, it is easy to see how these risk factors are associated. Teachers need to be alert to the association among these three areas of risk.

The sample for this study was drawn from a population of children referred as potentially gifted. Therefore, it does not constitute a truly random sample of children two standard deviations above the mean in intelligence test scores. However, the sample does accurately represent children who have been identified and certified gifted based on attainment of standardized intelligence test scores two standard deviations above the mean in a diverse school district that has come extremely close to achieving ethnic and cultural equity in its gifted education program. It represents children who have demonstrated their intellectual potential in an objective manner, despite varying levels of risk. Therefore, this sample powerfully illustrates the impact of risk factors on the expression of potential for gifted children.

Part 2:

Intelligence, Aptitude, and Achievement in Gifted Children With and Without Language Risk

Tracey L. Guertin, Nancy E. Johnson, and Dennis Saccuzzo*

San Diego State University

* This research was funded by Grant R206A00569, U.S. Department of Education, Jacob Javits Gifted and Talented Discretionary Grant.

The authors express their appreciation to the San Diego City Schools, to Gifted and Talented Education (GATE) Administrator David Hermanson, and to the following school psychologists: Will Boggess, Marcia Dorne, Eva Jarosz, Dimaris Michalek, Lorraine Rouse, Ben Sy, and Daniel Williams.

Correspondence concerning this article should be addressed to Dennis P. Saccuzzo, Joint San Diego State/University of California, San Diego Clinical Training Program, 6363 Alvarado Court, Suite 103, San Diego, California 92120-4913 (Telephone: 619-594-2844 / FAX: 619-594-6780 / e-mail: dsaccuzz@sunstroke.sdsu.edu).

© 1994
Do not reproduce in any form without express written permission from the authors.

Abstract

Test patterns and the role of risk factors were investigated for a large sample (5004) of children from an ethnically diverse school district. All children had IQ equivalents of 130 or greater on a major standardized intelligence test. Children with no risk factors were compared to children with a language/culture risk factor, and to a two-risk group of children with a language/cultural risk factor plus an additional risk factor. Children with language/culture risk showed their highest scores on nonverbal tests, including quantitative aptitude and mathematics achievement, but had significantly ($p < .05$) depressed scores, compared to the no risk group, in all verbal subtest areas. The data support Cummins' subtractive hypothesis, which states that bilingualism hinders the expression of a child's abilities until the child is completely competent in both languages.

Numerous studies support the hypothesis that being bilingual enhances a person's performance on a variety of cognitive tests (Ben-Zeev, 1977; Cummins, 1976, 1978, 1981, 1986, 1989; Cummins & Gulutsan, 1974; Dash & Misahra, 1988; Diaz, 1983; Feldman & Shen, 1971; Gallegos & Franco, 1985; Hakuta, 1987; Hakuta & Diaz, 1985; Hakuta & Garcia, 1989; Ianco-Worrall, 1972; Landry, 1974; Lindholm, 1991; Peal & Lambert, 1962; Zentella, 1981). In all of these studies bilingualism has been defined as adding a second language to an already well-developed language, or acquiring a second language to replace the first language. Cummins' (1976) threshold hypothesis best explains the enhanced performance of bilingual individuals by suggesting that once an unspecified threshold point of fluency in both languages is reached, the languages complement each other and add to the bilingual person's ability to perceive the environment from multiple cultural viewpoints. Theoretically, those who are developing bilingually are constantly monitoring and controlling two symbol systems that could possibly interfere with each other. Additionally, comparing two languages may increase a person's ability to work with abstract ideas, such as language or quantitative tasks, that are commonly referred to as "metacomponential abilities" (Dash & Mishra, 1988; Reynolds, 1991). Until a threshold point of bilingualism is reached, however, the process of learning and being evaluated in a second language can only be subtractive, thus hindering the complete expression of one's abilities.

Often, for minority language children in the American school system, neither English or the native language is adequately developed because native speakers of another language are immersed into classrooms where only English is spoken. The child's primary language is not used in the classroom; thus English is used only in a formal setting. The result is that children do not identify with either language and often speak a combination of the two; for example, "spanglish" for bilingual Spanish/English speaking children (Cauce & Jacobson, 1980). Teachers may erroneously assume that if a student is proficient in conversational English with peers, he or she is also English proficient in the classroom. Classroom proficiency, however, requires more than simply having an understanding of the language (Cummins, 1981). Cummins (1981) points out that parents may be encouraged by teachers or peers to speak to their children in English to help them obtain proficiency. However, since the parents are often not fluent, the child is at best exposed to poor English. At worst, parents may be uncomfortable speaking in a foreign language and consequently may not communicate with their children as much. Thus, having a native language other than English is a risk factor in American classrooms.

There is a cultural component coupled with any language risk factor a child may bring into the school system. A theory by Vygotsky (1962) states that language is initially used as a form of social communication and eventually evolves into a way of ordering thoughts and working with abstract symbol systems. In essence, speech and thought are not the same thing. Speech is simply one form of a symbolic thought process that humans use to communicate ideas (Ben-Zeev, 1977; Peal & Lambert, 1962; Vygotsky, 1962). Each society is in fact limited by its language because it can only express those thoughts, feelings, and experiences that the language has words to express. Therefore, learning a language is a socialization process that affects how one perceives the environment (Vygotsky, 1962). One's perception of the environment is often referred to as a cognitive set. Theoretically, a person who is bilingual may have a broader cognitive set, plus more cultural viewpoints from which to view any new experience, and thus may accumulate more crystallized intelligence (Cattell, 1963).

Becoming bilingual may also act as a disadvantage for children in terms of the testing measures traditionally used to assess intelligence (e.g., the WISC-R, WISC-III, or the Stanford-Binet Intelligence Scales) because most of the evaluations are performed in English, the minority language child's second language. The measures are additionally biased in favor of the Anglo American cognitive set and culture upon which they were based (Bernal, 1974; Melesky, 1985). As a result, poor scores are often obtained, and may be interpreted as a learning disability or lack of subject knowledge, instead of a demonstration of the level of second language fluency and cultural assimilation the child has attained (Ascher, 1990; Cummins, 1982; Ortiz, 1991).

The present study evaluated a large sample of gifted children who had either no risk factors, a language/culture risk factor, or language/culture and an additional risk factor. Their aptitude and achievement scores were examined and compared in order to answer a number of basic questions pertaining to children with language as a risk factor. We hypothesized that there would be a different pattern of test scores as a function of risk level for children with language risk. Since the bilingual children in this study were not fully competent in both languages, Cummins' subtractive hypothesis would be operative and result in relatively impaired performance.

Method

Subjects

The subjects consisted of 5004 children who had been certified as gifted based on high intellectual functioning (i.e., IQ equivalent ≥ 130) in the San Diego City School district between 1984 and 1990. IQ was measured with either the Weschler Intelligence Scale for Children-Revised or the Raven Standard Progressive Matrices Test. This was an ethnically diverse sample consisting of 295 Latino/Hispanic, 3985 Caucasian, 170 African-American, 350 Asian, and 204 Filipino children. Of these, 2,362 (47.2 percent) were female, 2,642 (52.8 percent) male. Children were distributed by grade as follows: 146 first, 2218 second, 1085 third, 535 fourth, 382 fifth, 347 sixth, 143 seventh, 73 eighth, 61 ninth, and 14 unknown.

The sample was divided into three groups based on risk: no risk, a language/culture risk, or two risks (a language/culture risk factor coupled with one additional risk factor). Figure 1 shows the percentage of children at various levels of risk. Of the sample of 5004 children, 655 (13.0 percent) had language/culture as a risk factor. Of these 655 children, 71 (10.8 percent) had an economic risk factor, 91 (13.9 percent) had an environmental risk factor, 88 (13.4 percent) had emotional risk factor, and 31 (4.7 percent) had a health risk factor.

Figure 1: Percentage of children with no risk, a language/ culture risk, or two risks, compared to their percentages in the sample as a whole.

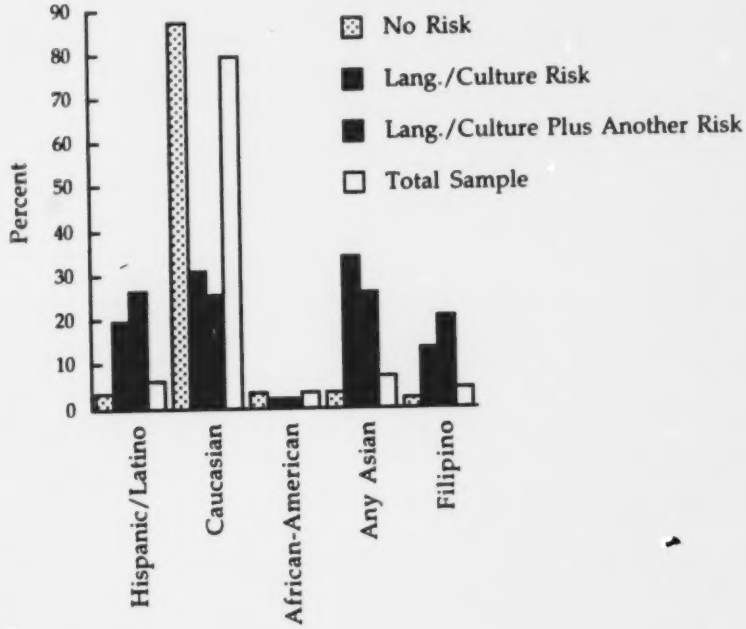


Figure 1 shows the percentage of children with no risk, a language/ culture risk, or two risks compared to their percentages in the sample as a whole. While Latino/ Hispanics represented about 6% of the total gifted sample, this group comprised about 23% of the children at language/ cultural risk.

Procedure:

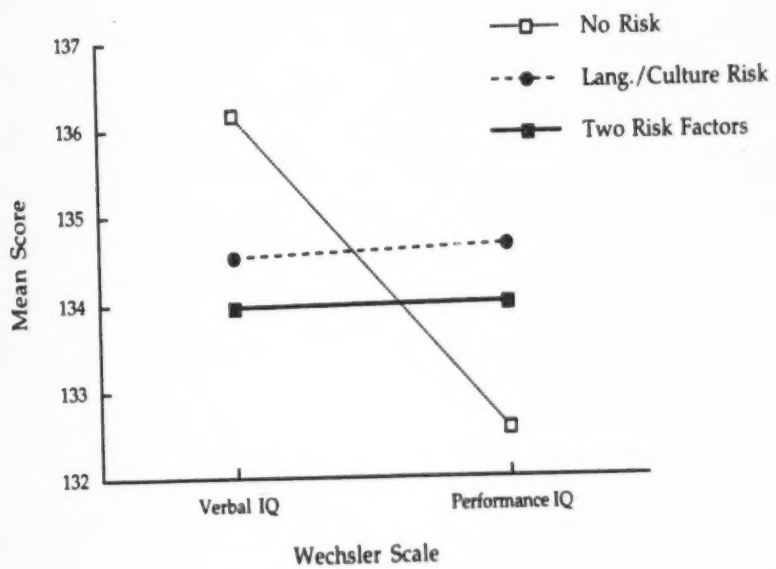
Each subject was referred for giftedness testing at San Diego City Schools by a parent, teacher, or through central nominations. Each was then individually evaluated with either the Wechsler Intelligence Scale for Children - Revised (WISC-R), or the standard form of the Raven Progressive Matrices (RPM) Test. In addition, each child was given the Developing Cognitive Abilities Test (DCAT). The DCAT is an aptitude test designed to predict academic achievement in verbal. quantitative, and spatial domains. To determine qualification for giftedness, a school psychologist then conducted a case study evaluation of each child using information from the individual evaluation, the Comprehensive Test of Basic Skills (CTBS; a standardized achievement test), and a consideration of risk. Risk was determined through a self-report questionnaire sent to the home and/or through a questionnaire completed by the teacher about the child. The five categories of risk were: language/culture (e.g. primary language other than English spoken in the home), economic (e.g. low income), emotional (e.g. death, divorce, seeking psychological services), health (e.g. physical disability, asthma), and environmental (e.g. frequent moves, academically unenriched home environment).

Results

WISC-R Verbal IQ (VIQ) and Performance IQ (PIQ) were analyzed in a 3 (Risk Level) X 2 (IQ Score) mixed repeated measures ANOVA with repeated measures on IQ Score. The significant main effect for IQ Score, $F(1, 4338) = 5.71, p < .05$, indicated that VIQ ($M = 136.02$, $SD = 8.72$) was significantly higher than PIQ ($M = 132.72$, $SD = 9.02$).

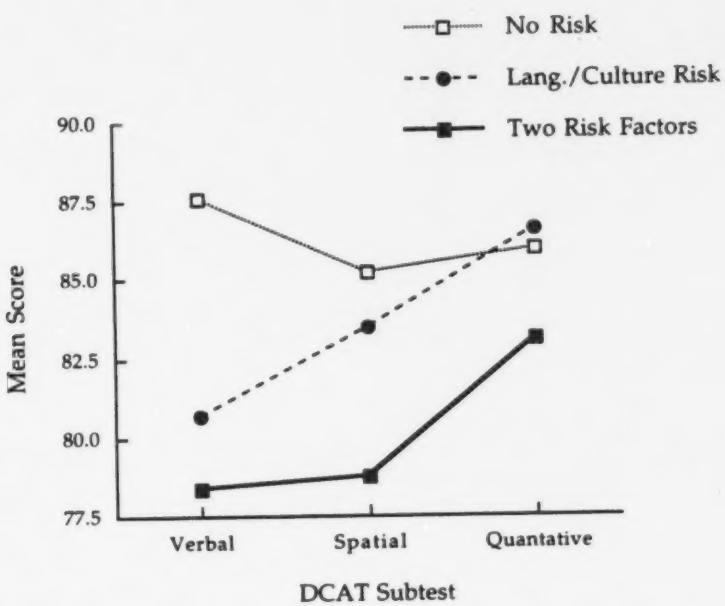
These results are qualified, however, by a significant Risk X IQ Score interaction, $F(2, 4338) = 14.10, p < 001$, illustrated in Figure 2. As confirmed by Newman Keul's post-hoc multiple comparisons, children with no risk had significantly higher VIQ scores ($M = 136.17$, $SD = 8.61$) than children with only a Language / Culture risk factor ($M = 134.52$, $SD = 10.10$; $p < .05$) or children with two risk factors ($M = 133.94$, $SD = 9.09$; $p < .05$). The PIQ scores, however, evidenced a reverse pattern in that PIQ scores were significantly lower ($p < .05$) for children with no risk factors ($M = 132.56$, $SD = 9.05$) than children with only a language/culture risk factor ($M = 134.67$, $SD = 8.89$). Lastly, a significant difference between VIQ and PIQ ($p < .05$) was found for children with no risk factors.

Figure 2: Risk level by WISC- R IQ score interaction.



Data for the DCAT were originally collected as percentile scores. These scores were converted to Z-scores and analyzed in a 3 (Risk Level) X 3 (DCAT Score: Verbal, Spatial, Quantitative) repeated measures ANOVA with repeated measures on DCAT Score. For ease of comprehension means, standard deviations, and figures are reported in Table 1 in terms of percentiles. There were significant main effects for Risk Level, F (2, 1340) = 20.78, $p < .001$, and DCAT Score, F (2, 2680) = 7.44, $p < .001$. Newman Keul's post-hoc comparisons showed significant differences between no risk children and those with a language/culture risk ($p < .01$) or a two risks ($p < .01$). Comparisons for the main effect of DCAT scores indicated that the spatial subtest scores were significantly lower ($p < .05$) than both the verbal and quantitative subtests.

Figure 3: Risk level by DCAT subtest score interaction.



The Risk X DCAT Score interaction was also significant, F (6, 2680) = 9.09, $p < .001$. Figure 3 illustrates this effect. As confirmed by Newman-Keuls post hoc multiple comparisons, children with two risks were impaired on all three DCAT measures of academic aptitude relative to children with no risk factors ($p < .05$). Additionally, those with only language/culture risk were significantly lower in verbal and spatial aptitude than the no risk group ($p < .05$). Lastly, the language/culture risk group scored significantly higher in spatial aptitude ($p < .05$) than those with two risks.

Table 1
Means and Standard Deviations of Z-Scores and Percentiles for the DCAT

	DCAT Verbal		DCAT Spatial		DCAT Quantative		Marginals	
	Z (*SD*)	Percentile (*SD*)	Z (*SD*)	Percentile (*SD*)	Z (*SD*)	Percentile (*SD*)	Z (*SD*)	Percentile (*SD*)
No Risk*	1.39 (0.78)	87.56 (12.90)	1.23 (0.76)	85.20 (15.87)	1.28 (0.70)	85.95 (14.69)	1.30 (0.73)	86.24 (14.48)
Lang/Cult Risk**	0.97 (0.81)	80.71 (18.43)	1.03 (0.86)	83.50 (18.05)	1.24 (0.77)	86.57 (15.72)	1.08 (0.81)	83.58 (17.40)
Lang/Cult + Another Risk***	0.89 (0.88)	78.37 (20.65)	0.88 (0.89)	78.79 (21.80)	1.14 (0.79)	83.11 (20.44)	0.97 (0.85)	80.09 (20.96)
Marginals	1.35 (0.78)	85.57 (15.21)	1.25 (0.77)	84.24 (17.06)	1.32 (0.73)	85.71 (15.61)		

* $n = 1331$
** $n = 305$
*** $n = 329$

For those with no risk factors, verbal scores were significantly higher than spatial ($p < .01$) and quantitative scores. Children with a language/culture risk factor demonstrated the same pattern as children with two risk factors in that verbal scores for both groups were significantly depressed compared to their quantitative scores ($p < .05$). Additionally, for the group with two risk factors, quantitative scores were significantly higher than spatial scores.

Data for CTBS Scores were analyzed in a 3 (Risk Level) X 3 (CTBS Score: Total Language, Total Reading, Total Math) repeated measures ANOVA with repeated measures on CTBS Score. As with the previous ANOVA's, there were significant main effects for Risk Level, F (2, 879) = 9.44, $p < .001$, and CTBS Score, F (2, 1758) = 103.16, $p < .001$. The Risk Level by CTBS Score interaction was also significant, F (4, 1758) =3.49, $p < .01$.

The main effect for Risk Level showed that children with no risk factors ($M = 7.89$, $SD = 1.05$) performed at a significantly higher level ($p < .05$) than those with two risk factors ($M = 7.56$, $SD = 1.21$). The main effect for CTBS showed that CTBS Total Math Scores ($M = 8.25$, $SD = 1.05$) were significantly higher ($p < .01$) than both Total Reading ($M = 7.52$, $SD = 1.08$) and Total Language scores ($M = 7.68$, $SD = 1.10$).

Figure 4: Risk level by CTBS subtest score interaction.

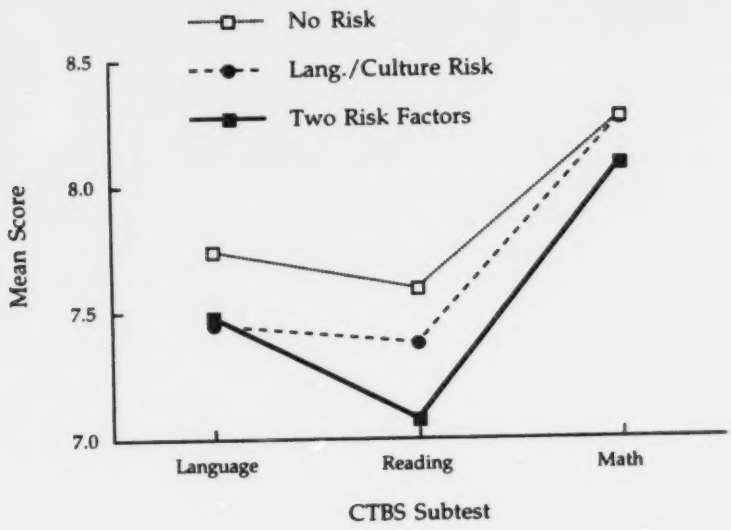


Figure 4 illustrates the Risk Level X CTBS Score interaction. As confirmed by Newman-Keuls post hoc multiple comparisons, both language (M = 7.45, SD = 1.20) and reading subtest scores (M = 7.38, SD = 1.08) were significantly ($p < .05$) depressed for the language/culture risk factor group when compared to the no risk group (language: M = 7.74, SD = 1.07; reading: M = 7.59, SD = 1.05). Children with two risk factors had significantly ($p < .05$) reduced scores in all three areas of achievement (language: M = 7.48, SD = 1.19; reading: M = 7.07, SD = 1.36; math: M = 8.08, SD = 1.08) when compared to the no risk group (math: M = 8.27, SD = 1.05). Children in the no risk group and the two risk group differed significantly in all three areas of achievement ($p < .01$). Math achievement was the highest, followed by language, then reading achievement scores. For children in the language/culture group, math scores were significantly higher than the language and reading scores ($p < .01$).

Discussion

We evaluated a large sample of gifted children across three levels of risk: no risk, language/culture risk only, and two risk factors (as evidenced by a language/culture risk plus one additional risk factor). The children were compared in terms of their pattern of intelligence test scores (i.e., for the VIQ and PIQ of the WISC-R), academic aptitude (DCAT), and academic achievement (CTBS).

Children with only language/culture as a risk factor consistently showed disadvantage, when compared to children with no risk, in verbal domains as opposed to nonverbal. These children showed slightly lower Verbal IQ scores and slightly higher Performance IQ scores than the no risk group. They additionally demonstrated their highest aptitude and achievement scores in the quantitative/math area, while performing below the no risk group in areas of verbal aptitude, language achievement, and reading achievement. From these data, it appears that children who are in the process of becoming bilingual demonstrate their giftedness through performance based tasks, such as quantitative/math type skills, in order to compensate for their verbal disadvantage. This finding is consistent with the theory that children in the process of becoming bilingual practice working with abstract symbol systems because they must switch language codes depending upon the given situation (Dash & Mishra, 1988; Reynolds, 1991). Consequently, these children have an advantage in the quantitative/math area, since the study of these subjects is simply another abstract symbol system.

Children with two risk factors demonstrated the same pattern of test scores as the language/culture risk children. The results are more devastating for the high risk group, however, because their scores were even more depressed compared to the no risk children.

Overall, the data indicate that language/culture acts as a significant risk factor for those children evaluated for gifted education. Because of limited English skills when tested, these children may often be excluded from programs in which they would excel if they were competent in classroom English. These data support Cummin's (1976) subtractive hypothesis that while these children are becoming competent in English, their bilingualism hinders the complete expression of their abilities. The language/culture risk children who were certified gifted with the WISC-R in this sample might actually be expected to show improvements in their IQ scores once English proficiency is obtained, given the generally high Performance IQs. There may be an even larger number of children who have been excluded from gifted education because their Performance IQs could not compensate for their current level of Verbal IQ performance, when verbal tests such as the WISC-R are used as the criterion for giftedness.

Children who are not native English speakers in the U.S. are often at a disadvantage in the educational system because of their lack of verbal proficiency. Present data indicate, however, that the strengths of these children can be found in nonverbal areas. The data also highlight the special needs and vulnerabilities that children with language risk have in all areas of verbal ability. Are these strengths and weaknesses only indicative of an English language deficiency, or are there additional variables, perhaps involving cultural discrepancies, that account for the language/culture risk group's patterns of test results? Once fluency is obtained in English for these at risk children, do their test patterns more closely resemble these of no risk children? Further research is needed to shed light on these questions.

CHAPTER 4

Information-Processing in Gifted Versus Nongifted African-American, Latino, Filipino, and White Children: Speeded Versus Nonspeeded Paradigms

Dennis P. Saccuzzo, Nancy E. Johnson, and Tracey L. Guertin

San Diego State University

Funded by Grant #R206A00569, Jacob Javits Discretionary Grant Program, U.S. Department of Education. Direct requests for reprints to Dennis P. Saccuzzo, San Diego State University, 6363 Alvarado Court, Suite 103, San Diego, CA 92120-4913.

The authors wish to thank Gerald Larson for providing the battery of tasks and for valuable input into this study. The authors also express their appreciation to the San Diego City Schools, to Gifted and Talented Education (GATE) Administrator David Hermanson, and to the following school psychologists: Will Boggess, Marcia Dorne, Eva Jarosz, Dimaris Michalek, Lorraine Rouse, Ben Sy, and Daniel Williams.

Correspondence concerning this article should be addressed to Dennis P. Saccuzzo, Joint San Diego State/University of California, San Diego Clinical Training Program, 6363 Alvarado Court, Suite 103, San Diego, California 92120-4913 (Telephone: 619-594-2844 / FAX: 619-594-6780 / e-mail: dsaccuzz@sunstroke.sdsu.edu).

© 1994
Do not reproduce in any form without express written permission from the authors.

Abstract

One hundred and sixty children were evaluated in a battery of four information-processing tasks: Inspection Time (backward masking paradigm), Reaction Time, Coincidence Timing, and Mental Counters (Working Memory). Half of the children were certified as gifted in a case study analysis; half were selected from the nongifted program in the same school district. Within each group (gifted vs. nongifted), half were in the 2nd-3rd grade, half in the 5th-6th grade. Finally, for each of the two main factors (giftedness and grade), there were an equal number of children from four ethnic backgrounds: African-American, Latino, Filipino, and White. There were large differences on all four information-processing tasks as a function of grade and membership in the gifted program. Only one significant interaction occurred involving ethnic background, in which gifted African-Americans showed the fastest RT's and nongifted African-Americans the slowest. Regression analysis revealed that measures of speed of processing, particularly Inspection Time, were the primary correlates of both IQ and membership in the gifted program. Overall, however, the relationship between the measures of processing and IQ were modest. Implications of these findings are discussed.

Information-Processing in Gifted vs. Nongifted African-American, Latino, Filipino, and White Children: Speeded vs. Nonspeeded Paradigms

A relatively little-used nontraditional method of selecting children from diverse backgrounds for gifted programs involves the analysis of information-processing abilities (Grinder, 1985; Sternberg, 1981). As Horowitz and O'Brien (1986) noted, "If different subcultures in the U. S. foster different styles of thinking on different strategies of information processing, then it should be possible to identify and describe these for each population" (p. 1148). Alternately, measures of information-processing may provide an unbiased method of selecting for giftedness.

Wagner and Sternberg (1984) identified information-processing as one of three main approaches to the concept of intelligence. The other two were the psychometric approach, which uses traditional standardized tests, and the Piagetian approach, which is based on Piaget's theory of cognitive development. In the information-processing approach, researchers attempt to analyze responses in terms of the basic component processes that underlie them. For example, information-processing begins initially with input of external stimulation. This input is then stored or held in a short-term storage or working memory system while analytical processes are performed. The results of this analysis are subsequently transferred to other systems, such as long-term memory, where new incoming information can be compared to one's present store of knowledge so that an appropriate response can be made. Theoretically, faster or more efficient information processors are better able to learn and to solve problems. Indeed, reviews of an extensive literature have supported the view that the speed or efficiency with which an individual can execute a small number of basic cognitive processes is highly related to one's performance on psychometric tests of intelligence such as the Wechsler Intelligence Scales and Raven Progressive Matrices Test (Jensen, 1982; Jensen & Reed, 1990; Larson & Rimland, 1984; Vernon, 1987; Vernon, Nador, & Kantor, 1985).

Thus far, two main variations of the information-processing approach have been advanced. Sternberg's (1981) theory emphasizes complex processes—"metacomponential" or executive skills, such as problem recognition, process selection, strategy selection, and solution monitoring. Sternberg's theory stresses the role of the ability to make inferences and apply previously made inferences to new domains, and of learning skills such as encoding and retrieval of information from long-term memory storage (Sternberg & Davidson, 1983). Although promising, this approach presently lacks a standard and widely accepted set of tasks to evaluate the various stages of processing. In addition, many of the skills are highly dependent on verbal ability, which may make them less suitable in selecting disadvantaged children.

A second information-processing approach, the one evaluated in the present study, attempts to tap into a basic ability that theoretically underlies performance on more complex tasks through the use of elementary cognitive tasks (Hunt, 1978; Jensen, 1982, 1987) that evaluate speed of information-processing. According to this view, gifted children are faster in their ability to encode and manipulate environmental input and to retrieve and analyze existing knowledge. Consistent with this speed of processing theory, Saccuzzo, Larson, and Rimland (1986) found that several measures of visual and auditory speed of processing, which contained little or no complex problem solving skills and required minimal language skills (only the ability to understand instructions) shared significant common variance with conventional standardized psychometric tests that did contain a high degree of intellectual content and involved complex problem solving.

Empirical support for a relationship between processing speed and individual differences in intelligence has come from reaction time studies that manipulate the level of uncertainty to which a subject must respond (Jensen, 1979; Jensen & Munro, 1979; Jensen & Reed, 1990; Lunneborg, 1978; Smith & Stanley, 1983; Vernon, 1981). Using parameters such as median reaction time, slope of reaction time as a function of the number of bits, and intraindividual standard deviations of reaction time

performance, investigators have reported large differences between retarded persons and those of normal IQ, as well as between vocational-college students and university students (Jensen 1980; 1982). Based on his own findings and a survey of the literature, Jensen (1982) estimated the correlation between reaction time and individual differences on IQ tests to be between -.3 and -.4. The correlations vary widely across samples, however (Lunneborg, 1978).

A number of investigators have found support for a relationship between speed of processing and giftedness (Span & Overtoom-Corsmit, 1986). Cohn, Carlson, and Jensen (1985), for example, found that gifted children differed fundamentally from average children in their speed of information-processing as evaluated in a reaction time paradigm. Cohn et al. (1985) compared a group of "bright-average" 7th-grade children to a group of academically gifted children of comparable age who were taking college-level courses in mathematics and science. Large and significant group differences were found on each of nine elementary reaction-time measures of speed of information-processing.

A second line of investigation, the study of speed of visual information-processing, also has supported a relationship between processing speed and performance on complex cognitive tasks. In the typical visual paradigm, the subject makes a discrimination for a briefly exposed "target" stimulus, such as identifying which of two lines presented to the right and left of central fixation is longer. The target stimulus is followed by a spatially overlapping non-informational mask (e.g., a uniform line that completely superimposes the lines of the target stimulus). An extensive literature on the masking task itself reveals that it limits the duration that the informational impulse provided by the target is available for processing in the central nervous system (Felsten & Wasserman, 1980). Speed of processing, or "Inspection Time" as it is usually called (Vickers, Nettelbeck, & Willson, 1972), is estimated by either systematically varying the exposure duration of the target and estimating the minimum duration needed for criterion accuracy (Lally & Nettlebeck, 1977; Nettelbeck & Lally, 1976), or by keeping the stimulus duration constant and varying the interval between the target and mask (Saccuzzo, Kerr, Marcus, & Brown, 1979; Saccuzzo & Marcus, 1983).

Numerous studies have reported a statistically significant difference between mentally retarded and non-retarded (average IQ) individuals in inspection time as evaluated in a backward masking paradigm. Such differences occur in spite of wide variations in the nature of the stimulus, method of stimulus presentation, and technique used to estimate visual processing speed (Saccuzzo & Michael, 1984). There are, moreover, clear-cut developmental differences. The general finding is a direct relationship between chronological as well as mental age and performance (Blake, 1974; Liss & Haith, 1970; Saccuzzo et al., 1979). Finally, the evidence supports a significant relationship between degrees of normal intelligence and visual processing speed; however, the magnitude of the relationship remains controversial (Mackintosh, 1981; Nettelbeck, 1982).

Though an early study reported an astonishing -.92 correlation between scores on the Performance Scale of the Wechsler Adult Intelligence Scale (WAIS) and Inspection Time (Nettelbeck & Lally, 1976), most subsequent investigators found a less spectacular, but significant, relationship between Inspection Time and intelligence, with a median correlation of about -.45. These positive findings have been criticized, however, on methodological grounds—small sample sizes (usually no more than 25 subjects); the inclusion of mentally retarded persons, which greatly inflates the correlation due to the extremely disparate range of performance relative to the sample size; and analyses based only on extreme scoring subjects, which, again, is well-known to inflate correlations (Irwin, 1984; Nettelbeck, 1982).

Nettelbeck (1982) took a careful look at his own and others' work in the area. Nettelbeck's analysis revealed a relatively small but consistent association between intelligence and Inspection Time. Irwin (1984) similarly found modest but significant correlations between Inspection Time and intelligence test performance. More recently, Nettlebeck (1987) provided an estimate of -.50 as the relationship between Inspection Time (IT) and intelligence. This estimate was subsequently confirmed by Kranzler and Jensen (1989) in a meta-analysis. Based on an extensive literature review and meta-analytic procedures, Kranzler and Jensen estimated that for adults, with general measures of IQ, the IT-intelligence correlation is about -.54 after correction for the effects of artifactual sources of error, and

-.30 prior to correction. Despite these promising findings, more work is needed to determine if gifted children can be distinguished from nongifted children on IT tasks, and whether they can be so distinguished in an unbiased manner.

A few studies have attempted to examine racial differences in speed of information processing. In a reaction time study, Lynn and Holmshaw (1990) compared 350 black South African 9-year-old children with 239 white British children on 12 reaction time tests. While the black children had slower decision times and greater variability than the white children, there were also tremendous IQ differences between the groups. The black children's mean Raven IQ corresponded to the first percentile and was equivalent to an IQ of about 65. The white children, by contrast, were in the 56th percentile, with an equivalent Raven IQ of 102. Because the black sample in this study was lower in IQ than is generally found for U.S. samples, these results have little, if any, generalizability to American black and white populations.

A study of racial differences in a backward masking paradigm is similarly limited. Bosco (1972) compared the performance of first- and sixth-grade black and white school children. There were clear differences in socioeconomic status between the whites, who were selected from a suburban area, and the blacks, who were selected from the inner city. Since race and socioeconomic background were confounded, the issue of the relationship between race and IT was unresolved.

To date, studies of information-processing and intelligence have focused on speed, with relatively little attention given to other information-processing tasks that might also underlie intelligent behavior. One such task is coincidence timing (CT), a task that requires subjects to respond at the instant two objects intersect or "coincide" (Dunham, 1977; Poulton, 1950).

Smith and McPhee (1987) traced the history of coincidence timing (Dorfman, 1977; Poulton, 1950; Thomas, Gallagher, & Purvis, 1981). As Smith and McPhee noted, coincidence timing relates to such everyday tasks as stepping on and off escalators, picking up an object on a conveyor belt, and predicting when one's changing of lanes on the freeway will coincide with a gap in traffic. In more primitive societies, coincidence timing also had survival value, as in predicting where to aim a spear to hit a moving animal. Coincidence timing tasks require subjects to attend to changing conditions, integrate information over time, and use that information to predict a future event (Smith & McPhee, 1987).

Smith and McPhee conducted the first published attempt to determine if a correlation exists between psychometric intelligence, as evaluated by the Standard Raven Progressive Matrices Test, and a coincidence timing task. These investigators administered a 10 minute CT task to 56 males and females of "high" to "moderate to high" socioeconomic status. Subjects were required to press a key at the very moment a moving target touched (coincided with) a stationary line. There was a significant negative correlation (-.294) between the number of errors on the CT task and Raven scores. In addition, there was a significant negative correlation (-.359) between intrasubject standard deviation (consistency of performance) and Raven scores.

As Larson (1989) noted, the correlation between Raven scores and coincidence timing adds a new dimension to the well-known correlation between psychometric intelligence and information-processing tasks in that, unlike previous tasks such as reaction time, coincidence timing does not require speed of processing, but rather attention and estimation. Thus, the task has potential for adding to the range of relatively simple tasks devoid of intellectual content that may be related to, and perhaps underlie, tests involving complex problem solving such as the Raven. Larson (1989) confirmed Smith and McPhee's finding of a significant relationship between the CT task and psychometric intelligence, as measured by the Armed Forces Qualifying Test (AFQT), in a group of 127 male Navy recruits. To date, however, it has yet to be determined if a coincidence timing task can distinguish gifted and nongifted children, or whether there are ethnic differences in this skill.

A question raised by Larson (1989) is whether some variable might underlie performance on reaction time, inspection time, and coincidence timing. One such common variable, according to Larson, may be working memory—the hypothetical cognitive work space for problem solving. As Larson (1989) noted, working memory provides a theoretical bridge between simple cognitive tasks and

psychometric tests, based on concepts such as "representational agility and/or fidelity" (p. 366). In the present study, we attempted to provide a direct test of Larson's theoretical bridge hypothesis through the use of a microcomputerized task of working memory called mental counters (Larson, 1986).

Method

Subjects:

Eighty children who had been certified as gifted by a school psychologist were compared to a matched sample of eighty nongifted children. For each of these two samples (gifted and nongifted) there were forty 2nd- to 3rd-grade children and forty 5th- to 6th-grade children. Each of the four subgroups of forty children had 10 African-American, 10 Filipino, 10 Latino/Hispanic, and 10 White children. The nongifted children were matched to the gifted children on the basis of age, race, and school district.

Procedure:

Giftedness was determined individually for each child by a school psychologist in a comprehensive case study analysis. This analysis considered recommendations by parents or teachers, a behavior checklist, achievement, standardized tests scores, and the presence of risk factors including economic disadvantage, cultural differences, English as a second language, and negative environments. Each child was given a battery of microcomputerized tests as follows: Inspection Time (IT), Choice Reaction Time (CRT), Coincidence Timing (CT), and Mental Counters (MC). These tests were presented on an IBM PC/XT microcomputer with a black and white monitor and standard keyboard. The tests were administered in counterbalanced order in one session, which lasted approximately one hour. Subjects were administered a standard Raven in a separate, second session. All subjects, and their parents, provided voluntary written informed consent for their participation. Nevertheless, one school district refused to allow the administration of the Raven; 18 children (11 gifted) did not receive the Raven. The specific parameters for each task in the information-processing battery are described below.

Inspection Time (IT). The inspection time (IT) task was a non-adaptive procedure based on the methods of Larson and Rimland (1984) and Saccuzzo and Larson (1987) and described in detail by Larson and Saccuzzo (1989). A target stimulus consisting of two horizontal lines of unequal length (17.5 mm and 14.3 mm) was briefly presented in the center of the computer monitor. The two lines appeared to the right and left of central fixation, with the longer appearing right or left on a random basis. Immediately following termination of the target, a backward visual noise mask, consisting of a single horizontal line that completely superimposed spatially on the target, was presented. The mask is known to limit the duration of the sensory signal delivered to the central nervous system by the target (Felsten & Wasserman, 1980). Targets were presented at one of five completely randomized stimulus durations: 16.7, 33.4, 66.8, 102.2, and 150.3 msec, which corresponded to 1, 2, 4, 6, and 9 refresh cycles on the video monitor. There were 10 trials per stimulus duration, for a total of 50 trials. The subject's task was to make a forced-choice discrimination, indicating which of the two lines of the target is longer, by pressing one of two keys on the microcomputer keyboard. The task began with a set of instructions, examples, and practice to criterion prior to the test proper. Subjects were given computer-generated visual feedback on their performance.

Choice Reaction Time (Hick Paradigm). A Hick paradigm for a 1,3, and 5 choice reaction time task, as described by Saccuzzo et al. (1986) and Larson and Saccuzzo (1989), was used to evaluate choice reaction time performance. A horizontal arrangement of lights was presented at the bottom of the monitor. All subjects were presented with 1-,3-, and 5-choice conditions, with order of presentation completely randomized. Open squares on the monitor were used as stimulus lights. Subjects responded by pressing the space bar as soon as a square was illuminated. The subject's forefinger rested lightly on the space bar, so that there was essentially no movement time involved. Previous research has shown that this "no movement" reaction time task is as effective as more traditional reaction time tasks involving movement (Kostas, Saccuzzo, Larson, 1987), and has the advantage of minimizing errors that occur due to the necessity of pressing two keys in the movement time paradigm. In this procedure, the subject views the monitor on which there are one, three, or five line drawn squares. After a random period of

time from 1.5 to 2.5 seconds, one of the squares is illuminated. Reaction time is defined as the number of milliseconds between the onset of the stimulus (i.e., where one of the stimulus squares is illuminated) and the instant the subject presses the space bar.

Coincidence Timing. The Coincidence Timing task was identical to that used by Larson (1989), based on the description provided by Smith and McPhee (1987). For each of three conditions, the subject's task was to press the space bar on the computer keyboard at the exact moment that a horizontally moving dot crossed a vertical line in the middle of the monitor. Condition 1 consisted of a dot that moved in a straight horizontal line at the speed of 0.10 meters per second, with random delays in the starting time. Condition 2 was identical to Condition 1 but at a speed of 0.15 meters per second. In Condition 3, the path of the dot was random (jagged), with a random delay and speed of 0.10 meters per second. The total distance traversed by the moving dot from orgin to crossing the line was 0.13 meters.

As in Larson (1989), there were 30 trials at each condition. Each trial consisted of a cycle in which the dot moved left to right across the screen, then right to left so that the dot crossed the centerline twice. Finally, since skill in tasks such as coincidence timing may be related to the type of skills that children develop playing video games such as Nintendo (Salthouse & Prill, 1983), each of the 160 children in the study were asked to estimate the number of hours per week that they spend playing video games in a self-report procedure prior to implementation of the information-processing tasks.

Mental Counters (MC). In the Mental Counters(MC) task (Larson, 1986), subjects are asked to keep track of the values of three independent "counters" that change rapidly and in random order. The task requires subjects to simultaneously hold, revise, and store three counter values that change rapidly. The counters themselves are represented as dashes on the video monitor (three side-by-side horizontal dashes in the center of the screen). The initial counter values are zero (0,0,0). When a small target (0.25 inch, hollow box) appears above one of the three dashes, the corresponding counter must be adjusted by adding one. When the target appears below one of the three dashes, the corresponding counter must be adjusted by subtracting one. The test items vary both in the number of targets and the rate of presentation. In the present study there were two different rates of presentation (0.633 seconds and 1.42 seconds), and 8 targets, such that the values of the initial counters changed 8 times. Order of presentation of speeds was counterbalanced. Prior to the test proper, subjects were given instructions, examples, and practice to criterion (three consecutive correct responses). The maximum and minimum counter values varied between +3 and -3, respectively. The subject's task was to select, from among four choices, the correct list of final values for the three counters. Selection was made by pressing the proper key on the keyboard. Feedback was given only during practice, and not during the test proper.

Results

Video Games.

Data for self-reported hours per week spent playing video games such as Nintendo were evaluated in a 2(GATE: gifted vs nongifted) X 4(Ethnic Background) ANOVA. The only significant finding was a main effect for GATE, $F(1,152) = 4.208$, $p < .042$. This result revealed that the gifted children spent significantly less time per week (about half) playing video games than the nongifted children, with means of 3.82 hours vs 6.04 hours, respectively. Thus, if prior practice at such tasks did make a difference, it would have been far in favor of the nongifted children, since they spent much more time playing video games. Notably, there were no ethnic differences in the number of hours spent playing these games.

Raven.

Table 1 shows the Raven scores for gifted vs nongifted children as a function of ethnic background. The table shows the average Raven Z scores based on the U.S. smoothed norms provided by Raven et al (1986). These data were subjected to a 2(GATE) X 2(Grade) X 4(Ethnic Background) ANOVA. As might be expected, there was a significant main effect, $F(1,135) = 42.69$, $p < .001$, for Gifted ($M = 1.11$, $SD = .92$) vs Nongifted($M = .02$, $SD = 1.0$) children. The only other significant finding was a GATE X Ethnic Background interaction, $F(3,135) = 3.58$, $p < .05$. Newman-Keuls post hoc multiple comparison tests of this difference revealed the gifted White, African-American, and Filipino children did not differ significantly among themselves and all three of these groups were significantly higher than the gifted Latino children and each of the four nongifted groups, none of whom differed significantly among themselves. It should be noted, however, that of the 11 gifted children who did not receive Raven, 6 were in the Latino group. The absence of these children may have artificially lowered the overall mean for the Latino children.

Table 1.

Raven Z-Scores as a Function of Ethnic Background for Gifted versus Nongifted Children

	Latino/Hispanic		White		African-American		Filipino	
	Gifted	Nongifted	Gifted	Nongifted	Gifted	Nongifted	Gifted	Nongifted
M	0.51	0.36	1.36	0.01	1.34	-0.38	1.09	0.16
SD	1.17	0.79	0.78	0.81	0.58	0.92	0.95	1.31

For each of the four information-processsing variables, all *F* values, significance levels, means, and standard deviations are presented in Table 2 to conserve space. Whereas Grade reflects differences between 5th and 6th versus 2nd and 3rd graders, GATE reflects differences between Gifted versus Nongifted children, and Condition reflects the condition under study, such as Stimulus Duration, Choices, and Fast vs. Slow.

Table 2
Summary of significant findings

Significant Effects	*df*	*F*	Level	*M*	*SD*
Inspection Time					
Main Effect: Grade	1/140	36.73***	5th - 6th Grade	66.17	13.19
			2nd - 3rd Grade	57.50	14.68
Main Effect: GATE	1/140	7.84**	Gifted	63.78	14.62
			Nongifted	59.83	15.01
Main Effect: Stimulus Duration	4/560	80.12***	Duration 1	52	10.7
			Duration 2	57	13.4
			Duration 3	57	15.7
			Duration 4	68	17.2
			Duration 5	74	18.3
Grade X Inspection Time	4/560	8.73***			
GATE X Inspection Time	4/560	3.76**			
Reaction Time (msec)					
Main Effect: Grade	1/135	56.83***	5th - 6th Grade	383	90.55
			2nd - 3rd Grade	564	133.47
Main Effect: GATE	1/135	6.21*	Gifted	422	113.75
			Nongifted	467	139.70
Main Effect: Choices	2/278	141.99***	One Choice	384	117.71
			Three Choices	454	127.01
			Five Choices	479	142.00
Grade X Choices	2/278	4.17*			
GATE X Choices	2/278	5.08**			
GATE X Ethnicity	3/139	3.23*			
Coincidence Timing (Errors)					
Main Effect: Grade	1/140	36.27***	5th - 6th Grade	18.34	7.51
			2nd - 3rd Grade	29.16	17.87
Main Effect: GATE	1/140	19.95***	Gifted	19.80	8.89
			Nongifted	27.73	18.01
Main Effect: Condition	2/280	94.76***	Slow, NonVariable	16.95	11.39
			Fast, NonVariable	25.18	14.69
			Random	29.32	18.21
Grade X Condition	2/280	3.75*			
GATE X Condition	2/280	3.58*			
Mental Counters					
Main Effect: Grade	1/112	48.00***	5th - 6th Grade	10.84	4.11
			2nd - 3rd Grade	6.46	3.76
Main Effect: GATE	1/112	7.08**	Gifted	9.68	4.34
			Nongifted	8.34	4.59
Main Effect: Condition	1/112	66.00***	Slow	10.17	5.07
			Fast	7.87	3.95
Grade X Condition	1/112	8.99**			
GATE X Condition	1/112	6.41**			

* $p < .05$
** $p < .01$
*** $p < .001$

Inspection Time (IT).

The data for IT were analyzed in a 2(Grade) X 2(GATE) X 4 (Ethnic Background) X 5 (Levels of Stimulus Duration) mixed repeated measures ANOVA, with percent correct at each duration used as the dependent measure. There were significant main effects for Grade, GATE, and Stimulus Duration (See Table 2). There were also two significant interactions: Grade X Inspection Time, and GATE X Inspection Time.

Figure 1. Inspection Time: Grade by stimulus duration interaction.

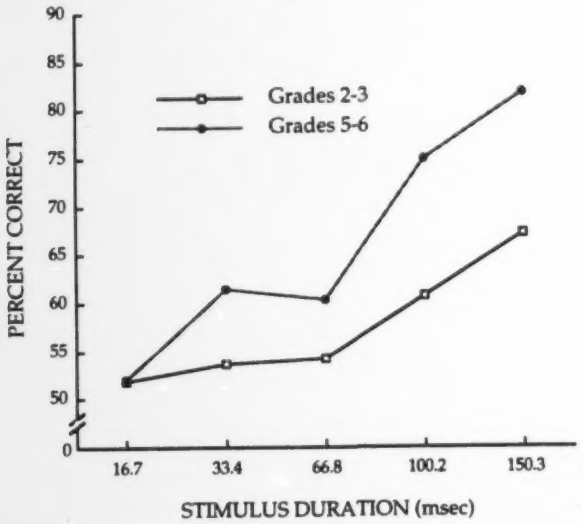


Figure 1 illustrates the Grade X Inspection Time interaction. As inspection of Figure 1 reveals, and as confirmed by post-hoc multiple comparison tests, the children in grades 5-6 had significantly better performance ($p < .01$) at each of the five levels of inspection time except the first/fastest speed, where both groups performed approximately at chance level.

Figure 2. Inspection Time: GATE by stimulus duration interaction.

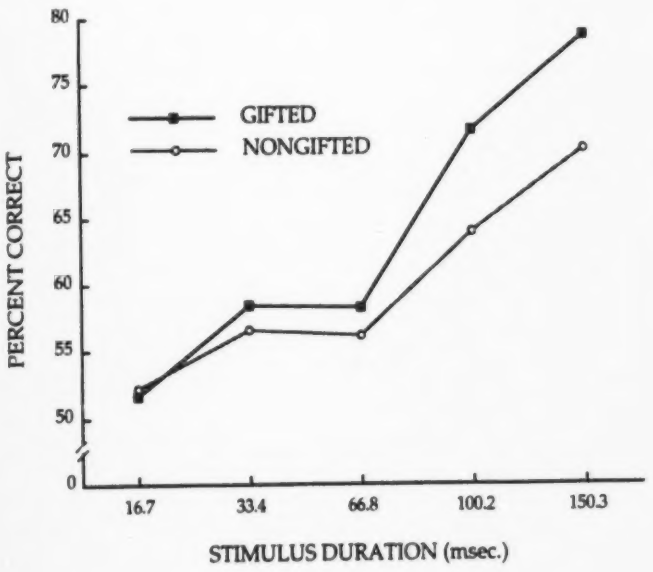


Figure 2 illustrates the GATE X Inspection Time (IT) interaction. As this figure shows, and as confirmed by post-hoc multiple comparisons tests, the gifted children had significantly ($p<.01$) better performance at the two slowest speeds (IT4 and IT5). The groups did not differ significantly ($p > .05$) at the three fastest speeds, where the tendency of the younger children to perform at chance obscured differences between gifted and nongifted children at Speeds 2 (IT2) and 3(IT3), and all subjects were at chance at the fastest speed (IT1).

Reaction Time.

The median reaction time for each subject was analyzed in a 2(Grade) X 2(GATE) X 4(Ethnic Background) X 3(Choices) mixed repeated measures ANOVA. There were significant main effects for Grade, GATE, and Choices (See Table 2). There also were three significant interaction effects: Grade X Choices, GATE X Choices, and GATE X Ethnicity.

Figure 3. Reaction Time: Grade by level of choice interaction.

Figure 3 illustrates the Grade X Choices interaction. While the children in grades 5-6 outperformed the children in grades 2-3 at each level of choice, the difference between the groups increased as the number of choices increased.

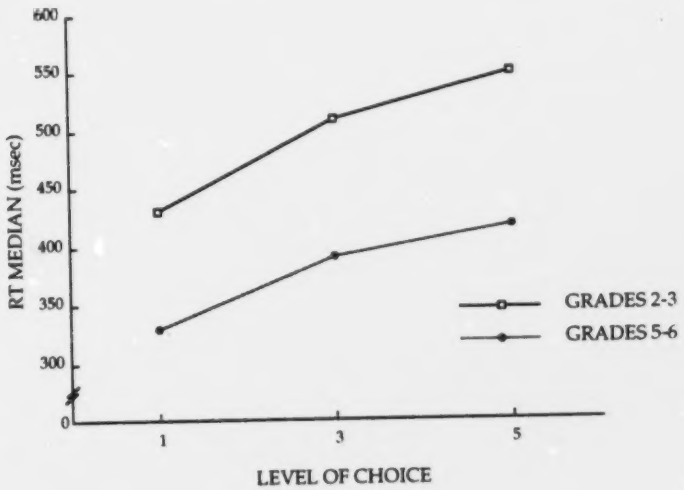


Figure 4. Reaction Time: Gate by level of choice interaction.

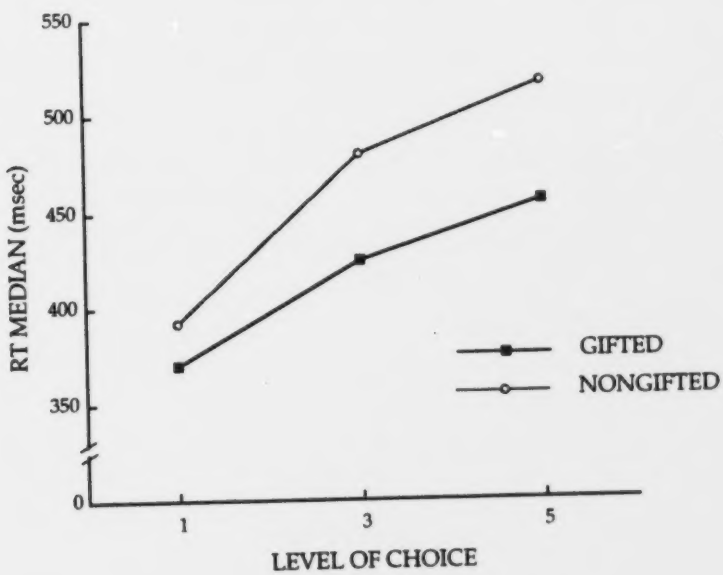


Figure 4 illustrates the GATE X CHOICES interaction. The groups did not differ ($p > .05$) at the one choice condition, but were significantly different at the 3 and 5 choice conditions ($p < .01$).

Figure 5. Reaction Time: GATE by ethnicity interaction for reaction time median.

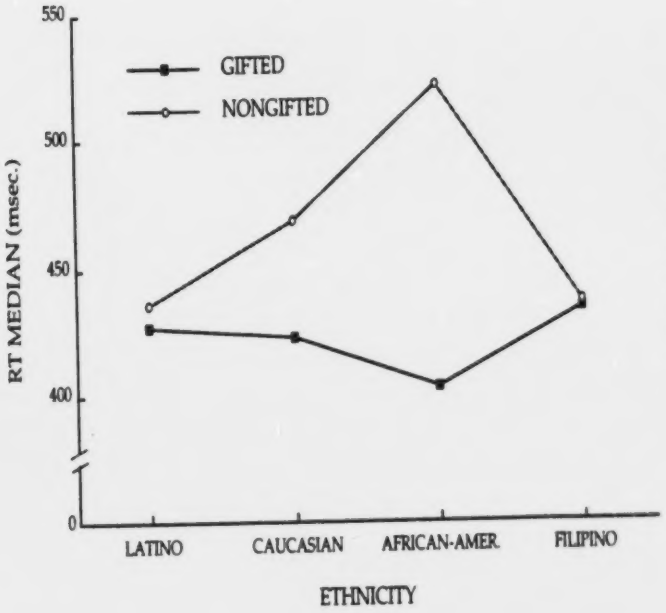


Figure 5 illustrates the GATE X Ethnicity interaction. Post-hoc multiple comparison tests of this effect revealed a statistically significant difference between gifted African-Americans and the nongifted African-Americans. The other differences between gifted and nongifted groups for each ethnic background did not reach statistical significance.

The individual variability of reaction time (RT Variance) was also analyzed in a 2(Grade) X 2(GATE) X 4(Ethnic Background) X 3(Choices) mixed repeated ANOVA. For this analysis, the only significant finding was the main effect for Grade, $F(1,138) = 11.02$, $p < .001$. The GATE X Ethnic Background effect did not reach statistical significance ($p > .081$).

Coincidence Timing (CT).

Two dependent measures were used to evaluate the coincidence timing data: Coincidence Timing Errors (CTE), which refers to the mean of the absolute value of the difference between the response position and the true position of the line; and Coincidence Timing Standard Deviation (CTSD), which refers to the standard deviation of the distribution of response positions. The error (CTE) and Standard Deviation (CTSD) data were separately analyzed in a 2(Grade) X 2(GATE) X 4(Ethnic Background) X 3(Conditions) mixed repeated measures ANOVA. Results were nearly identical for both dependent measures. For CTE there were significant main effects for Grade, GATE, and Condition (See Table 2). There were two significant interactions in the CTE data, the Grade X Condition, and the GATE X Condition.

Figure 6. Grade by condition interaction (CTE).

Figure 6 illustrates the Grade by Condition interaction for the Coincidence Timing errors. In this interaction, while the children in grades 5-6 outperformed children in grades 2-3 at all levels, they did so at a greater rate for the variable condition (Condition 3).

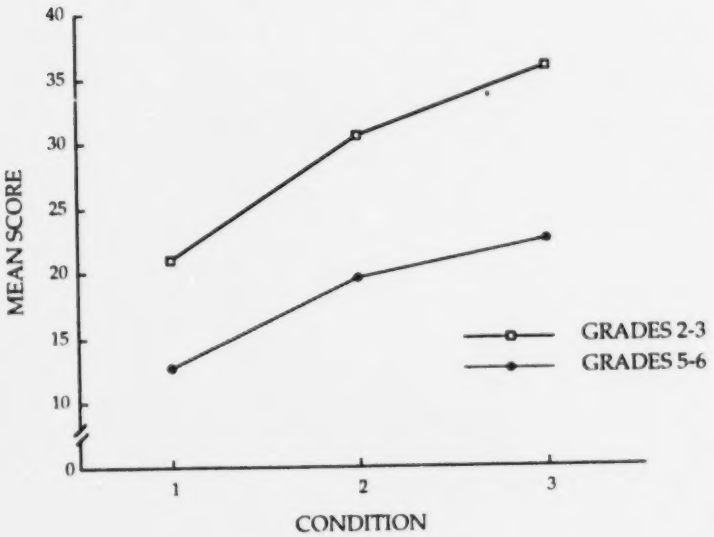


Figure 7. Gate by condition interaction (CTE).

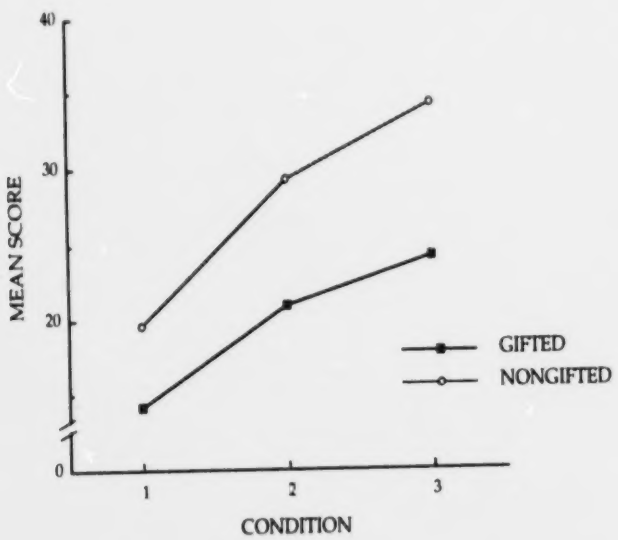


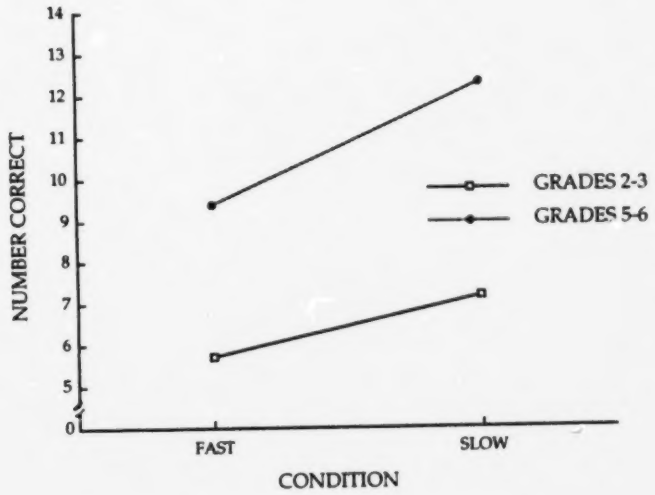
Figure 7 illustrates the GATE X Condition interaction, and again shows the greatest difference occurring between the groups under the variable condition (Condition 3).

The analysis of standard deviations produced all the same main effects as well as a GATE X Condition interaction. The only difference between the two measures was that the Grade X Condition interaction did not reach statistical significance for the standard deviation data. For both CT measures, there were no main or interaction effects involving ethnicity.

Mental Counters.

For the Mental Counters Test, the number of correct responses was analyzed in a 2(Grade) X 2(GATE) X 4(Ethnic Background) X 2(Conditions - Fast and Slow) mixed repeated measures ANOVA. Results were parallel to those obtained with Inspection Time and Coincidence Timing. There were the familiar main effects for Grade, GATE, and Condition. As with the prior analyses, there were two significant interactions: Grade X Condition, and GATE X Condition. Figures 8 and 9 illustrate these interactions.

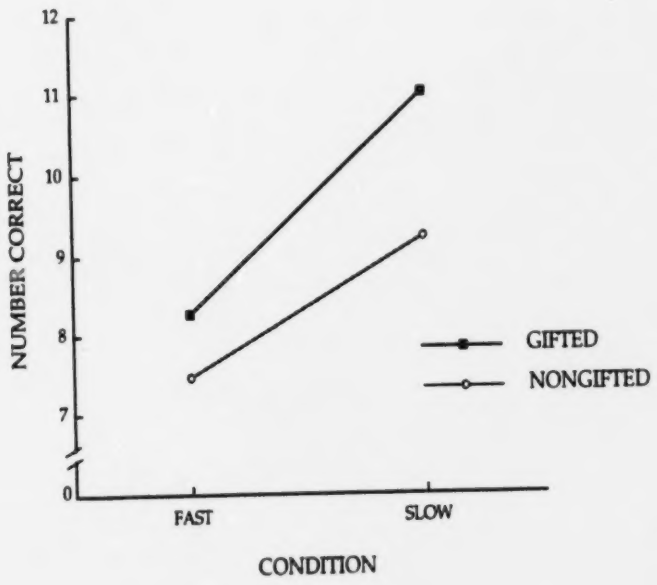
Figure 8. Mental Counters: Grade by condition interaction.



In the Grade X Condition interaction, as shown in Figure 8, the children in grades 5-6 outperformed children in grades 2-3 at both conditions, but did so at a greater rate for the slow condition.

Figure 9. Mental Counters: Gate by condition interaction.

In the GATE by Condition interaction, as shown in Figure 9, the differences between the groups were significant ($p < .01$) only at the slow speed.



Other Analyses.

Multiple regression analysis was used to determine the information-processing predictors of Raven IQ scores and of placement in the GATE program. First, the following variables were used to predict Raven scores in a stepwise multiple regression: the five levels of inspection time, (IT1, IT2...IT5); each of the three reaction time choices for both variability and median RT; each of the three conditions of coincidence timing for both errors (CTE) and standard deviation (CTSD); and the two levels of mental counters. Only one of these information-processing variables, IT4(Inspection Time, duration 4) entered into the equation and produced a significant F value, $F(1,102) = 13.38, p < .0004$. The multiple R between IT4 and the Raven was .34. Next, each of the above information-processing variables were used to predict GATE membership in a stepwise regression analysis. Three variables were significant in predicting GATE status: IT5, $F(1, 118) = 8.45, p < .005$, CTSD(condition 3), $F2, 117 = 6.65, p < .002$, and reaction time variance (5 choice condition), $F(3, 116 = 6.13), p < .001$. The multiple R between IT5 and GATE membership was .258. Adding in CTSD (condition 3) increased the multiple R to .319. With the addition of reaction time variance (5 choice condition), the multiple R increased to .370.

Finally, an attempt was made to determine a possible cut-off score for the information-processing tasks to discriminate gifted from nongifted children. Given that IT5 was the best predictor of GATE membership, we began with this variable. First, a discriminant analysis was conducted to determine the best score to discriminate the gifted vs the nongifted children. For IT5, this score was 73.5 percent correct. Next, frequency tables were constructed to determine the frequency of gifted vs nongifted children who scored above or below the cut-off. Twenty-one out of 77 gifted children (27 percent) scored below the cut-off; thirty-two out of 79 nongifted children (40 percent) scored above the cut-off. Results were similar for other information-processing tasks, which suggested that the use of these tasks to make individual decisions would indeed be hazardous.

Discussion

The present study adds to the literature in being the first to examine the information-processing abilities of children and the relationship between IQ and information-processing as a function of three major variables: grade (age), giftedness (as determined by an individual case study analysis by a school psychologist), and ethnic background. Whereas most of the relevant studies in this field are restricted to one or at most two measures of information-processing, the present study examined four different measures, two of which depended heavily on speed of processing (IT and RT) and two of which did not depend exclusively on speed. All information-processing tasks, however, can best be described as elementary cognitive tasks (ECTs), in that they are essentially devoid of complex content and problem solving skills.

All of the tasks easily discriminated older children as a group versus younger children. This finding is consistent with known developmental differences in choice reaction time and backward masking paradigms, and further shows that such differences can be extended to coincidence timing and mental counters, which is believed to reflect working memory capacity.

The analyses of gifted versus nongifted differences in specific information-processing abilities yielded a number of critical interaction effects. For inspection time, gifted and nongifted children did not differ at the faster stimulus durations, where performance for both groups remained close to chance. As the stimulus duration increased, significant differences between the groups emerged. These differences are consistent with faster information-processing in the gifted children. In the reaction time paradigm, the differences between gifted and nongifted children occurred only for the three and five choice conditions, and were greater as the number of choices increased. Again, this significant interaction is consistent with faster processing (i.e., faster decision time) in the gifted group. Similarly, the greatest difference between gifted and nongifted children in coincidence timing occurred for the most variable condition. In the mental counters task, the fast condition was too difficult for all subjects; chance performance was the result for both groups. In the slower condition, however, the gifted children

clearly outperformed the nongifted children. In sum, excluding simple reaction time and a level of difficulty so great that virtually all subjects were at chance, the gifted children showed a general superiority across all four elementary cognitive tasks.

The superiority of the gifted children was essentially independent of ethnic background. There were no ethnic differences for inspection time, coincidence timing, and mental counters. Median reaction data did reveal a significant interaction between ethnic background and GATE membership. The gifted African-Americans had the fastest reaction times of all, whereas the nongifted African-Americans had the slowest. This result is of interest in that previous RT studies with African-Americans have studied only low or, at best, low-average to average IQ African-Americans. The general result has been slower choice RT's in the African-Americans compared to Whites. The present results show that among gifted African-Americans, reaction times are at least comparable, if not faster, than among other ethnic backgrounds. This finding warrants further investigation as it is suggestive of two different subgroups of African-Americans based on reaction time.

Regression analyses were conducted to determine if the relationships between information-processing and IQ and between information-processing and GATE membership are due to speed of processing, or to a factor (or factors) other than speed. The results revealed that inspection time was the only significant predictor of Raven scores. This finding parallels that of Larson (1989), who used the same battery of information-processing tasks (except mental counters) on a group of 127 male Navy recruits. Larson found that inspection time was the only significant predictor of a measure of IQ based on the Armed Forces Qualifying Test (AFQT).

Three information-processing variables predicted GATE membership: Inspection Time (IT5), Coincidence Timing (CTSD, Condition 3), and Reaction Time (5 Choice RT). The additional information-processing predictors of GATE membership may be attributable to the absence of 18 Raven scores. On the other hand, this result more likely reflects the multi-dimensional approach of the case study analysis used to select gifted children, as opposed to the use of a score on a single test. In either case, it is clear that the predominant underlying factor is speed. Both IT and RT involve speed of processing. Moreover, while Condition 3 of the CT task involves randomness, this task is also faster than Condition 1 of the CT task and equal in speed to CT2. It is reasonable to conclude that the addition of randomness in CT Condition 3 favored faster processors. In any case, speed of processing clearly was the predominant factor in the gifted-nongifted differences that were found in the information-processing tasks.

An attempt to identify cut-off scores for the information-processing tasks failed to produce a reliable method of discriminating gifted vs nongifted children. Thus, while information-processing tasks may have relevance for our theoretical understanding of giftedness, there are no indications at present that such tasks could be used to make decisions about individuals. Much more work will be needed if such tests are to become practical. Moreover, the relationship between these elementary cognitive tasks and IQ or GATE membership remained low, with multiple correlations of .34 and .37, respectively. These correlations are in line with others reported in the literature. Therefore, it would appear that speed of processing by itself is insufficient to account for giftedness or intelligence level, and that the use of a variety of elementary cognitive tasks adds little. Thus, for a full account of individual differences in intelligence in terms of information-processing, it would appear necessary to go beyond the elementary cognitive tasks and examine more complex information-processing skills as suggested by Sternberg (1981). In order to account for what is being measured by complex IQ tests, it appears necessary to examine the full range of information-processing skills.

CHAPTER 5

Ethnic and Gender Differences in Locus of Control in At Risk Gifted and Nongifted Children

Susan C. McLaughlin and Dennis P. Saccuzzo*

San Diego State University

* This research was funded by Grant R206A00569, U.S. Department of Education, Jacob Javits Gifted and Talented Discretionary Grant.

The authors express their appreciation to the San Diego City Schools, to Gifted and Talented Education (GATE) Administrator David P. Hermanson, and to the following school psychologists: Will Boggess, Marcia Dorne, Dimaris Michalek, Ben Sy, and Daniel Williams.

Thanks should also be expressed to Nancy E. Johnson and Tracey L. Guertin for their assistance in data collection and analysis.

Correspondence concerning this article should be addressed to Dennis P. Saccuzzo, Joint San Diego State/University of California, San Diego Doctoral Training Program, 6363 Alvarado Court, Suite 103, San Diego, California 92120-4913.

© 1994
Do not reproduce in any form without express written permission from the authors.

Abstract

The effect of ethnicity, gender, and risk on locus of control were investigated for gifted children and for high ability nongifted children. Eight hundred and five 5th through 7th grade African-American, Caucasians, Latino/Hispanic and Filipino children who had been referred for an evaluation of giftedness were evaluated in a case study analysis that included an evaluation of intellectual ability and the presence of one or more of six risk factors. Each child was given the Nowicki Strickland Locus of Control Scale for Children. A 2(Gifted vs. NonGifted) X 4(Ethnic Background) X 4(Level of Risk) ANOVA revealed significant ($p < .01$) main effects for Giftedness, Ethnic Background, and Level of Risk, as well as a significant Ethnic X Risk Interaction ($p < .038$). In addition, a 2(Gender) X 2(Giftedness) X 4(Ethnic Background) ANOVA yielded a significant ($p < .024$) main effect for Gender. Overall, higher internal locus of control was associated with female Caucasians not at risk. However, in contrast to Caucasians, greater risk was associated with a higher internal locus of control in nonCaucasians. Results confirm previous findings in showing a more internal locus of control in gifted children, and further indicate that for gifted and intellectually bright nonCaucasians, risk is associated with, and may serve to strengthen, a greater internal locus of control. Results support the use of locus of control as an alternative in identifying gifted traditionally underrepresented groups such as African-Americans and Latino/Hispanics.

Ethnic and Gender Differences in Locus of Control for Gifted and Nongifted Children With and Without Risk

Locus of control is a theoretical construct referring to the degree to which a person perceives a relationship between his or her own behaviors and the outcomes of those actions (Rotter, 1966). The most widely used instrument to measure locus of control is the Internal-External Scale developed by Rotter (1966). According to Rotter's theory, a person who assumes control and responsibility for the events in his or her life is said to have an internal locus of control. When a person attributes responsibility to outside sources, such as chance, luck or fate, he or she is said to have an external locus of control. Investigators have found that students who attribute their successes to their own efforts and abilities and their failures to a lack of effort will probably attempt a failed task again. Those students who attribute their successes to luck and their failures to lack of ability, however, are less likely to re-attempt a failed task (Payne & Payne, 1989; Weiner, 1977).

In examining several locus of control studies, Rotter found strong support for the hypothesis that individuals who have a strong belief that they can control their own destinies are likely to a) be more aware of environmental factors that may influence future behavior; b) take steps to improve environmental conditions; c) place greater value on skill or achievement reinforcement; and d) be resistive to conformity and other subtle attempts to influence their behavior (see Rotter, 1966). In a review of the literature on the locus of control variable, Lefcourt (1976) found that individuals with an internal rather than external locus of control were more perceptive, inquisitive and efficient in processing information.

One of the main criticisms of Rotter's Internal-External Scale is that it is not suitable for children. Nowicki and Strickland have developed a measure to extend the investigation of the locus of control variable to children (Nowicki & Strickland, 1973). This measure has been used to examine several dimensions of child behavior. Empirical findings have revealed that locus of control becomes more internal with age (Nowicki & Strickland, 1973; Brown et al., 1984). As children grow older, more is expected of them and they are given an opportunity to succeed; thus, their perceptions of their ability to control their academic progress will become more internal (Payne & Payne, 1989). Internality has also been associated with higher social class and ethnicity, with middle class whites being most internal (Nowicki & Strickland, 1973; Crandall, Katkovsky & Crandall, 1965).

An extensive body of research has explored the relationship between locus of control and achievement. Nowicki and Strickland (1973) found a negative relationship between the locus of control and achievement of children in grades 3 through 12. As achievement scores went up, external scores went down; the children became more internal. This was particularly true for males. Gordon (1977) studied 113 fourth grade children and found that academic achievement, as measured by grades or achievement tests scores, could be predicted by knowing a child's locus of control score. Crandall, Katkovsky and Crandall (1965) measured locus of control with the IAR (Intellectual Achievement Response) Questionnaire, which is a measure aimed at assessing children's beliefs in reinforcement responsibility exclusively in intellectual academic situations. They reported that a higher internality score on the IAR was positively correlated with at least two measures of academic achievement.

Locus of control has been used to assess different populations. Fincham and Barling (1978), for example, found significant differences in locus of control between learning disabled, normal achieving and gifted children, with learning disabled being the most externally oriented and gifted children the least externally oriented. Gifted children have been identified as having a greater internal locus of control than nongifted children (Delisle & Renzulli, 1982; McClelland, Yewchuk, & Mulcahy, 1991). Laffoon, Jenkins-Friedman, and Tollefson (1989) looked at 137 achieving gifted, underachieving gifted and nongifted students in third, fourth and fifth grades. Their results indicated that gifted underachievers and nongifted students were significantly more external than achieving gifted students. They also found that the underachieving gifted and nongifted students made significantly more luck attributions for their failures.

Recently, an area of increasing interest has been in ethnic differences in locus of control (Chiu, 1986). Hsieh, Shybut and Lotsof (1969), for example, studied Anglo-American, American Chinese and Hong Kong students. Their findings suggested that cultural orientation may be closely related to a personal belief in internal versus external control. Individuals raised in a culture that values independence, uniqueness, self-reliant individualism, and personal output of energy are likely to be more internally oriented than individuals from a culture that tends to emphasize a different set of values. Hsieh et al. (1969) also found Anglo-Americans to be more internally oriented than Chinese Americans who were, in turn, more internally oriented than Hong Kong Chinese, suggesting the importance of the role that cultural context plays in the socialization process. In another study of culture and locus of control, Battle and Rotter (1963) compared 80 black and white sixth and eighth graders. These investigators found middle class whites to be the most internal and lower class blacks to be the most external. Similar findings have been shown in other studies (Nowicki & Strickland, 1973; Gurin, Gurin, Lao & Beattie, 1969; Brown, Fulkerson, Fur, Ware & Voight, 1984). Studies of motivation and performance of black students suggest that blacks are less likely to hold strong beliefs of internal control and that social class and race probably interact so that lower class blacks stand out as externally oriented.

In an attempt to explain differences in locus of control, Payne and Payne (1989) hypothesized that at-risk children will have a more external locus of control than children not considered at risk. The presence of certain external variables such as low socioeconomic status makes a child at risk. In a study of 643 black and white students classified as either at-risk or not-at-risk, Payne and Payne (1969) found that at-risk students had a significantly greater tendency to attribute their achievement and life experiences to external forces and influences. In contrast to other investigators, however, Payne and Payne found no main effect of locus of control for race. Browne and Rife (1991) also looked at locus of control orientation of at-risk and not-at-risk sixth grade students. They defined at-risk in terms of the following variables: previous grade failures and retentions, attendance, prior disciplinary actions, family income, and number of parents in the family. They found that students at risk tended to have a more external locus of control. Studies of risk are limited, however, in that there is a lack of consistency in the definitions of at-risk children. In addition, previous studies have failed to consider the amount of risk and level of cognitive ability for each child.

The literature shows that there is a positive relationship between locus of control and academic achievement. To date, however, no one has studied the effects of risk, ethnicity, cognitive ability and gender on the locus of control of children. The present study attempted to fill this gap in the literature. We examined the locus of control scores of children with no risk factors, one risk factor, two risk factors and three or more risk factors, as described below, to determine the effect of the presence of different levels of risk on locus of control. Furthermore, we compared gifted and nongifted children across several ethnic categories. Finally, we considered the role of gender.

Method

Subjects:

The subjects consisted of 805 fifth through seventh grade students who had been referred for an evaluation of giftedness and whose parent provided informed consent to include the Locus of Control Scale as an experimental test whose results would not be used in determining giftedness. Of these, 190 were Latino/Hispanic, 341 Caucasian, 155 African-American, and 119 Filipino; 435 were female, 370 male.

Procedure:

Each child was evaluated for giftedness in a case study evaluation by a school psychologist. The case study considered scores on tests of intelligence and achievement. In addition, each child was evaluated for the presence of risk factors. A risk factor was operationalized as the presence of one or

more of the following six variables: environmental, economic, language, culture, social/emotional and health. Environmental risk included transiency (three or more changes in schools) and excessive absence from school because of home responsibilities such as child care duties or working to help support the family. Economic risk included parental unemployment or low income. Language risk included speaking English as a second language and lack of fluency in English. Cultural risk included cultural values and beliefs that differ from those of the dominant culture or limited experience in the dominant culture. Emotional risk encompassed such factors as death of a parent, child abuse, major psychiatric illness in the home, or extended absence of the parent because of military service. Health factors included vision, speech, and hearing deficits that required designated instructional service; motor problems that required adaptive physical education; or diseases that caused absences or hampered school progress, such as asthma or diabetes. Of the subjects, 85 had no risk factors, 114 had one risk factor, 236 had two risk factors, 370 had 3 or more risk factors.

At the time of their evaluation for giftedness, each child was given the Nowicki Strickland Internal External Locus of Control Scale for Children (NSLOCS). The NSLOCS is a 40 item paper and pencil instrument in which the child answers "YES" or "NO" to such questions as "Do you believe that most problems will solve themselves if you just don't fool with them?" and "Do you believe that whether or not people like you depends on how you act?". A high score on the NSLOCS indicates externality. Nowicki and Strickland have reported internal reliability coefficients ranging from .68 to .81. The NSLOCS has also been found to correlate with other measures of locus of control such as the Rotter I-E Scale (Rotter, 1966) and the Bialer-Cromwell Scale (Bialer, 1961).

Data on Locus of Control were not made available to the school psychologist who conducted the giftedness evaluation. The psychologists used objective test results to determine giftedness. All children who obtained an IQ score two standard deviations above the mean on a standardized test of intelligence such as the Wechsler Intelligence Scale for Children-Revised (WISC-R) were automatically certified for the gifted program. In addition, children with two or more risk factors who obtained an IQ score of 120 or greater were certified as gifted. For the purposes of the present analysis, only those children who scored two standard deviations above the mean on a standardized individual intelligence test were included as "gifted." Of the total sample, 364 met the criterion. Of these, 131 were Latino/Hispanic, 147 were Caucasian, 24 were African-American, and 62 were Filipino.

Results

To examine risk factors and possible interactions of risk with giftedness and ethnicity, the data were analyzed in a 2(Giftedness: Gifted vs. NonGifted) X 4(Ethnic Background: Latino/Hispanic, Caucasian, African-American, Filipino) X 4(Level of Risk: 0, 1, 3, risk factors) ANOVA. There were significant main effects for Giftedness, $F_{(1,804)} = 8.31$, $p < .004$, Ethnic Background, $F_{(3,804)} = 6.29$, $p < .001$, and Level of Risk, $F_{(3,804)} = 2.84$, $p < .037$. Also significant was the Ethnic X Risk Interaction, $F_{(9,804)} = 1.99$, $p < .038$.

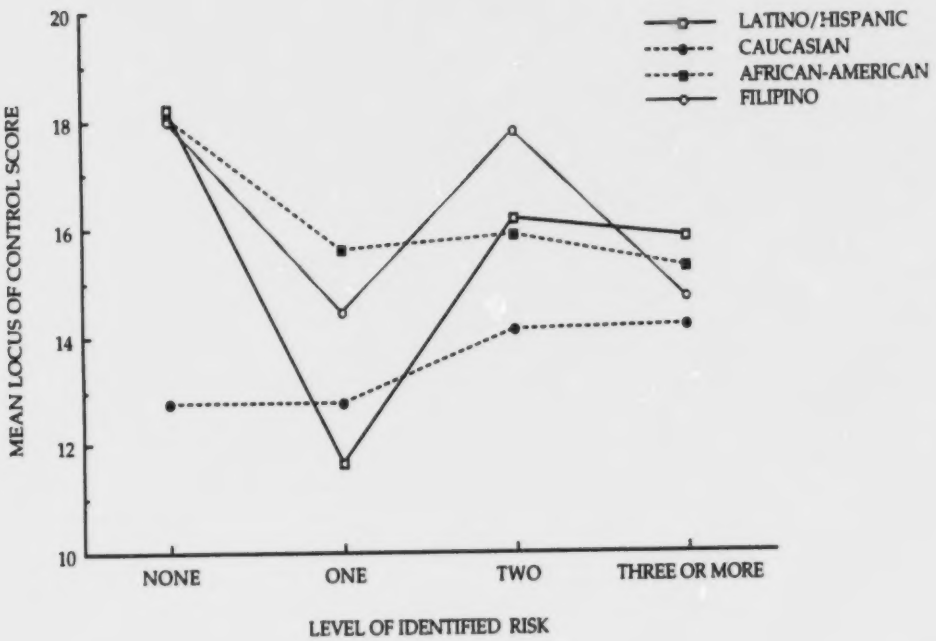
The main effect for Ethnic Background showed that the Caucasian children ($M = 13.74$, $SD = 4.57$) had a significantly more internal locus of control than the Filipino children ($M = 14.73$, $SD = 4.37$), who, in turn, were significantly more internal than Latino ($M = 15.54$, $SD = 4.96$) and African-American children ($M = 15.90$, $SD = 4.40$).

The main effect for risk showed that children with two ($M = 15.27$, $SD = 4.86$) and three or more risk factors ($M = 15.01$, $SD = 4.49$) had a significantly more external locus of control than children with only one risk factor ($M = 13.42$, $SD = 4.56$) indicating that, summing across the other variables, the more risk factors a child has, the more likely he or she will be to attribute successes to external causes.

Figure 1 illustrates the Ethnic Background by Level of Risk Interaction. For the Caucasians, having no risk factors was associated with a higher internal locus of control, and the children became more external as risk level increased. For the other three groups, with the exception of one data point

(Latino/Hispanic with one risk factor), the reverse was found. That is, for these nonCaucasians, greater risk was associated with a higher internal locus.

Figure 1. Locus of control as a function of risk and ethnic background



To evaluate gender effects and possible interactions among gender, giftedness, and ethnic background, the data were evaluated in a 2(Gender) X 2(Giftedness) X 4(Ethnic Background) ANOVA. As with the previous ANOVA, there were significant main effects for Giftedness and Ethnic Background. The main effect for Gender was also significant, $F(1, 804) = 5.15$, $p < .024$. This effect was due to a higher internal locus in the females ($M = 14.40$, $SD = 4.65$) compared to the males ($M = 15.23$, $SD = 4.67$).

Discussion

The results revealed that, overall, gifted children have a more internal locus of control than nongifted children. This result is not surprising, and is consistent with findings from Laffoon, Jenkins-Friedman, & Tollefson (1989). Laffoon et al. (1989) found that high achieving gifted students had a significantly higher internal locus of control than both underachieving gifted and nongifted students. Other studies have also found internal locus of control to be related to giftedness (Fincham & Barling, 1987) and achievement (Keith et al., 1986; Harty et al., 1984).

There were also ethnic differences in locus of control. The results of the present study revealed that Caucasian children have a more internal locus of control than Filipino, Latino, and African-American children. These findings are consistent with Hsieh et al. (1969), who found Anglo-American students to have a more internal locus of control than other ethnic groups. These findings suggest that cultural orientation may be closely linked to an individual's belief in external or internal control. As Hsieh et al. (1969) suggest, an individual who is raised in a culture that emphasizes independence, self-reliance, and individuation will typically develop a more internal locus of control than individuals who are raised with a different set of values. This is an important finding considering the positive relationship between internal locus of control and achievement. If children, and specifically traditionally

underrepresented or disadvantaged children, are underachieving in school, one possible area on which to focus may be increasing the child's internal locus of control. The discrepancies in intelligence and achievement scores may be due to differences in socialization processes as opposed to deficits in intellectual abilities.

Level of risk also affected locus of control. Overall, children with two or more risk factors had a significantly more external locus of control than children with none or only one risk factor. Browne & Rife (1991) and Payne & Payne (1989) also found that at-risk students tended to ascribe their achievements and successes to outside, "external" causes. A child is generally considered at-risk if specific circumstances in the child's life affect his or her ability to perform at full potential. The child typically has little or no control over these variables. Language and cultural factors, for example, may influence a child's ability to perform in school, yet the child has no control over what culture into which he or she is born. It follows that the presence of multiple risk factors may lead the child to feel that he or she has little control over his or her environment and thus, develop an external locus of control.

Findings with level of risk must be considered in conjunction with ethnic background, as there was a significant interaction between risk and ethnic background. This interaction indicated that for nonCaucasians the presence of risk factors was actually associated with a greater internal locus of control. Perhaps these children respond to adversity by becoming more internal. In any case, there was a clear association between risk and internal locus of control for gifted nonCaucasians. Whether these results generalize to children of average or below average ability, however, remains to be seen, and would seem unlikely based on previous studies (Brown & Rife, 1991; Payne & Payne, 1989). Thus, a high internal locus may serve as a marker for at risk gifted nonCaucasians.

There were also gender effects in locus of control. Females showed a slight but significantly greater internal locus of control. These results are consistent with Young and Shorr (1986) and Cooper et al. (1981), who found that females tended to attribute both success and failure outcomes to internal causes significantly more often than males. This difference may be a result of differences in socialization of girls and boys. However, several other studies have failed to find any differences in locus of control between males and females (Payne & Payne, 1989; Browne & Rife, 1991; Brown et al., 1984). Furthermore, while the differences in locus of control for the present study were significant, in general all subjects in this gifted and high ability sample tended to be more internal. More research is needed in order to determine the extent of differences in locus of control for males and females of average or below average abilities.

In general, our results further support the conclusion that internal locus of control is positively related to academic success, including identification for gifted programs. In addition, female students were found to be more internal than male students. Several factors have been identified that appear to influence an individual's locus of control. One factor that may lead to a more external locus of control is cultural orientation. The extent to which a culture believes in independence and self-reliance will possibly effect the degree to which a person perceives control over his or her successes and failures. A second variable that appears to affect internal versus external locus of control is the number of risk factors attributed to the individual. It appears that the more risk factors a child has, the less internal control the child perceives. However, the effects of number of risk factors must be looked at in conjunction with ethnicity and IQ. The results of the present study suggest that for high IQ scoring nonCaucasians the presence of multiple risk factors may actually serve to increase internal locus of control. Thus, locus of control has multiple determinants and interacts with risk and ethnicity.

Future work in this area should be directed at examining, more specifically, how measures of locus of control might be used to produce equity in selecting diverse children for gifted programs. In the present study locus of control was used as an experimental tool. Scores on locus of control were not used for selection purposes. Certainly such measures have shown promise and merit further investigation.

CHAPTER 6

Understanding Gifted Underachievers in an Ethnically Diverse Population

Nancy E. Johnson, Dennis P. Saccuzzo, & Tracey L. Guertin

San Diego State University

* This research was funded by Grant R206A00569, U.S. Department of Education, Jacob Javits Gifted and Talented Discretionary Grant.

The authors express their appreciation to the San Diego City Schools, to Gifted and Talented Education (GATE) Administrator David Hermanson, and to the following school psychologists: Will Boggess, Marcia Dorne, Dimaris Michalek, Ben Sy, and Daniel Williams.

The authors also wish to acknowledge Susan McLaughlin for her assistance.

Correspondence concerning this article should be addressed to Nancy E. Johnson, Joint San Diego State/University of California, San Diego Clinical Training Program, 6363 Alvarado Court, Suite 103, San Diego, California 92120-4913 (Phone: 619-594-2845/FAX: 619-594-6780/E-mail: njohnson@psychology.sdsu.edu).

© 1994
Do not reproduce in any form without express written permission from the authors.

Abstract

A well defined sample of gifted underachievers was compared to a sample of gifted high-achievers. All children had full scale WISC-R IQ scores of 130 or greater. Underachievers were performing at or below the 50th percentile in at least one major area of achievement, whereas high-achievers were at the 96th percentile or greater in three areas of achievement: language, math, and reading. Of 6,067 children who had obtained full scale IQ scores of 130 or greater over a nine year period in an ethnically diverse population, 108 met criteria for gifted underachievement, and 96 met criteria for high achievement. Results of a 2 (achievement level) by 9 (WISC-R subtest) mixed repeated measures ANOVA revealed significant ($p < .01$) differences in scores on four verbal subtests: Information, Similarities, Vocabulary, and Comprehension. High-achievers had significantly ($p < .001$) higher Verbal, but not Performance, IQ scores than underachievers. However, comparison of the VIQ-PIQ discrepancy distributions for the children in the two groups revealed no significant differences. This finding negates the idea that a large VIQ-PIQ discrepancy can be used as an indicator of risk for low achievement in gifted children, since large VIQ-PIQ discrepancies were as likely to be seen in high-achievers as in low. Analysis of gender, ethnicity, and risk revealed a greater concentration of nonCaucasian males with at least two risk factors in the underachieving group. Present findings are consistent with, and confirm those of others concerning the importance and discriminating power of the Information subtest in distinguishing high versus underachievers. The findings indicate that gifted underachievers are not as motivated or interested in acquiring traditional factual information as high-achievers. Creative teaching strategies are recommended to maximize the talents of underachievers.

Understanding Gifted Underachievers in an Ethnically Diverse Population

Traditionally, gifted underachievers are defined as those children who cannot or will not perform at a level of academic achievement commensurate with their intellectual potential (Emerick, 1989; Fine, 1967; Gowan, 1955). Underachievement manifests itself as a discrepancy between a child's performance in the classroom and his or her intellectual ability (Rimm, 1988); a discrepancy between what is expected and what is actually accomplished (Newell, & d'Lberville, 1989).

As Gowan (1955) noted some time ago, gifted underachievers represent one of the greatest social wastes in our culture. Gifted underachievers are children of exceptional ability who achieve at average or even below average levels. Unfortunately, gifted underachievers tend to be overlooked because such children perform at relatively good levels (Wolfe, 1991). Thus, while gifted children may be as susceptible to factors that cause underachievement as are children of normal intelligence, their underachievement is less likely to be recognized because of their giftedness (Supplee, 1989).

According to various estimates, between 10% and 20% of high school dropouts are judged to have very superior ability (Lajoie & Shore, 1981; Nyquist, 1973; Whitmore, 1980). Ten to fifteen percent of the academically gifted are believed to achieve at a rate far below their potential (Gallagher, 1985; Ford, 1992). Consequently, an increasing number of researchers have called for more study of these gifted children who fail to fulfill their high potential and yet are so easily missed, or dismissed as lazy, manipulative or irresponsible (Emerick, 1989; Ford, 1992; Gallagher, 1985; Wolfle, 1991).

Because they usually perform at satisfactory levels, gifted underachievers are difficult to identify, and consequently have proved resistant to systematic scientific inquiry. Much of the available research has been devoted to the problem of identification (Ford & Harris, 1990; Mather & Udall, 1985). Some studies have looked at the role of the family (VanTassel-Baska, 1989) or socioemotional consequences (Cornell, Callahan, & Lloyd, 1991). Still other reports have used case studies to examine gifted underachieving children (Hannel, 1990).

A major line of investigation has been concerned with test patterns in order to better understand and operationalize underlying correlates of underachievement in gifted children. The basis for the search for test patterns can be found, in part, in evidence that suggests that gifted children process information in a qualitatively different manner from average children on tests such as the WISC-R (Brown & Yakimowski, 1987). Moreover, in a study of WISC test patterns of bright and gifted underachievers, Bush and Mattson (1973) found that normal achievers and underachievers differed on three subtests: Information, Arithmetic, and Digit Span. In a related study, Moffitt and Silva (1987) examined children from an unselected birth cohort who had WISC-R Verbal and Performance IQ discrepancies that placed them beyond the 90th percentile. Underachieving children in this sample were found to have depressed a Verbal IQ relative to the Performance IQ.

In the present study, we continued the exploration of the test patterns of gifted underachievers. A well-defined sample of gifted underachievers was compared to a well-defined sample of gifted high-achievers, to explicate differences in patterns of subtest scores as well as verbal-performance discrepancies.

Method

Subjects:

The subjects were drawn from children who were referred for an evaluation of giftedness in the San Diego School District between 1984 and 1993. The San Diego City School District consists of over 123,000 children who attend more than 130 elementary, middle, and high schools across a wide geographic and ethnically diverse area. Children may be referred for a giftedness evaluation by teachers, parents, or central nomination from the District office. Each child referred is examined by a school psychologist who conducts a case study analysis including a consideration of IQ, achievement, aptitude, and risk factors. For each child evaluated, the psychologist determines whether the child has one or more of five

risk factors as follows: cultural/language, economic, emotional, environmental, and health. Children who score two standard deviations above the mean on a standardized IQ test are automatically certified as gifted. Children may also be certified as gifted based on a combination of high achievement, high IQ and risk factors.

Procedure:

Between 1984 and 1991 the vast majority of children evaluated for giftedness (more than 95%) were administered the Wechsler Intelligence Scale for Children-Revised (WISC-R). A total of 9,315 children had been given the WISC-R during this time period. From these 9,315 children, we identified all who had a Full Scale IQ of 130 or greater (i.e., two standard deviations above the mean or greater). A total of 6,067 children met this criterion. From this group of high IQ children, a group of underachievers was obtained by selecting all children who scored at the mean (i.e., 50th percentile) or lower on the Total Reading, Language, or Math scores of the Comprehensive Test of Basic Skills (CTBS). Such children would therefore have at least a two standard deviation discrepancy between IQ and achievement. A total of 108 children representing an ethnically diverse sample met this criterion. To obtain a high-achieving group, all children who had all three achievement scores in the 96th percentile or higher were selected. A total of 96 children met this criterion. For the underachievers, 11 were Latino, 73 Caucasian, 10 African-American, 7 Asian, and 7 Other (Native-American, Indochinese, Filipino, or Pacific Islander). For the high-achieving sample, 2 were Latino, 78 Caucasian, 4 African-American, 2 Asian, and 10 Other. Chi Square analysis was conducted to determine if there were significantly more nonCaucasians represented in the underachieving group. Compared to an expected 50-50 split, results revealed that there were significantly more nonCaucasians in the underachieving group $\chi^2(1, N = 108) = 5.45$, ($p <$ .02). There were no significant differences in numbers of Caucasians in the two groups ($p > .05$). In terms of risk factors, 56 high-achievers had none, 23 had one, and 17 had two. In the underachieving group 61 had no risk factors, 23 had one risk factor, and 24 had two risk factors. There were no statistically significant differences between the two groups in the number of children in each risk category. In the high-achieving group, 49 were female, 47 male. In the underachieving group, 40 were female and 68 were male. Males were overrepresented in the underachieving group, $\chi^2(1, N = 108) = 7.26$, $p < .007$.

Results

Table 1 shows the mean subtest performance for the nine subtests that were routinely given to the majority of the subjects. To evaluate differences in subtest performance between high and underachievers, the groups were compared in a 2 (Achievement Level) X 9 (Subtests) mixed repeated measures ANOVA. There were significant main effects for Achievement, $F(1, 131) = 17.16$, $p < .001$, and for Subtests, $F(8, 1048) = 35.14$, $p < .001$. Post-hoc multiple comparisons revealed that the high-achievers scored significantly higher ($p < .01$) on 4 subtests: Information, Similarities, Vocabulary, and Comprehension.

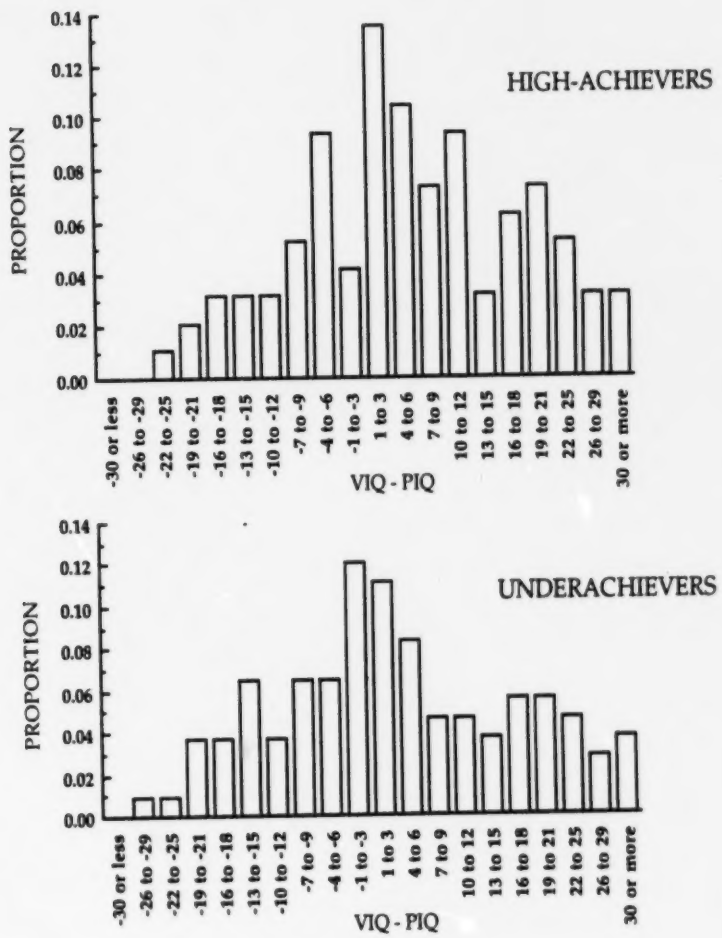
Table 1.
WISC-R Means and Standard Deviations for Subtest Performance by High and Underachievers.

WISC-R Subtest	High-achievers		Underachievers		Entire Sample	
	(*M*)	(*SD*)	(*M*)	(*SD*)	(*M*)	(*SD*)
Information	14.78	(2.09)	13.88	(1.87)	14.30	(2.02)
Similarities	17.35	(1.99)	16.65	(1.97)	16.97	(2.01)
Arithmetic	14.73	(2.33)	14.40	(2.15)	14.55	(2.24)
Vocabulary	15.98	(2.08)	15.40	(2.08)	15.67	(2.09)
Comprehension	17.23	(1.76)	16.13	(1.97)	16.69	(1.94)
Picture Completion	13.76	(2.44)	13.90	(2.14)	13.83	(2.44)
Picture Arrangement	14.70	(2.47)	14.67	(2.51)	14.68	(2.49)
Block Design	15.39	(2.53)	14.82	(2.51)	15.09	(2.53)
Object Assembly	14.44	(2.86)	14.01	(2.73)	14.21	(2.79)

Since all of the differences found were for Verbal subtests, high-achievers and underachievers were compared in a 2 (Achievement Level) X 2 (Verbal versus Performance IQ) ANOVA. PIQ scores for high-achievers (M = 132.2; SD = 9.7) and underachievers (M = 130.6; SD = 9.1) did not differ significantly. However, VIQ scores did differ significantly, $F(1, 202) = 13.5$, $p < .001$, with a mean of 137.8 (SD = 8.5) for the high-achievers and a mean of 133.4 (SD = 7.8) for the underachievers.

To investigate the possibility that high-achievers and underachievers differ in individual VIQ - PIQ discrepancy scores, VIQ - PIQ frequency distributions for the two groups were compared. No significant differences were found (Kolmogorov-Smirnov $Z = 1.007$, $p = .263$). As can be seen in Figure 1, relatively large VIQ - PIQ discrepancies were as likely to be seen in high-achievers as in low achievers.

Figure 1. Distribution of VIQ - PIQ differences at the extremes of achievement.



Performance was further analyzed through correlational analysis and stepwise multiple regression (see Table 2). Table 2 shows the intercorrelation matrix of the WISC-R subtests and CTBS (Language, Reading, and Math) scores. Stepwise multiple linear regression was performed, with the nine Wechsler subtest scores as predictors and level of achievement (i.e., whether the child was in the high versus underachievement group) as the criterion. Three subtests were significant in predicting achievement level. The first variable that entered into the equation was the Information subtest, with a multiple R of .29, $F(1, 131) = 12.08$, $p < .001$. The Comprehension subtest added significant variance, $F(2, 30) = 10.1$, $p < .001$, and increased the multiple R to .37. Finally, the Block Design subtest significantly, $F(3, 129) = 8.5$; $p < .001$, increased the multiple R to .41.

Table 2.

Correlation Matrix for WISC-R Subtests and Achievement Scores

	INFO	COMP	ARITH	SIMS	VOCAB	PC	PA	BD	OA
INFO	1.00								
COMP	.22	1.00							
ARITH	.11	.07	1.00						
SIMS	.07	.18*	.09	1.00					
VOCAB	.40**	.24**	.11	.29**	1.00				
PC	-.01	-.11	.02	-.07	.07	1.00			
PA	-.08	-.11	.02	.11	.06	.12	1.00		
BD	.02	-.16	-.07	-.12	-.06	.06	.03	1.00	
OA	-.11	-.07	-.06	.08	.09	.18*	.36**	.31**	1.00
CODING	-.21*	-.05	.20*	-.06	-.03	.01	-.05	-.07	-.12
CTBSL	.26**	.29**	.05	.10	.15	-.10	-.04	.09	.10
CTBSR	.23**	.23**	.02	.10	.12	.02	.01	.11	.11
CTBSM	.05	.17	.07	.12	-.04	-.04	.01	.16	.03

	CODING	CTBSL	CTBSR	CTBSM
CODING	1.00			
CTBSL	.08	1.00		
CTBSR	.11	.71**	1.00	
CTBSM	.09	.52**	.40**	1.00

Note.: CTBSL = CTBS Total Language
CTBSR = CTBS Total Reading
CTBSM = CTBS Total Math

* $p < .05$
** $p < .01$

To aid in understanding the gender and ethnic differences between high-achievers and underachievers, the groups were further compared in terms of gender, risk, and ethnicity simultaneously. Chi Square analysis revealed significantly more male, nonCaucasians with 1 or more risk factors in the underachieving group: $\chi^2(1, N = 33) = 5.50$, $p < .019$.

Discussion

The present study compared intellectually gifted children who were achieving at least two standard deviations below expectation to a very high-achieving sample. In general, the high-achieving sample had slightly higher IQ scores. This superiority, however, was attributable only to Verbal subtests. The high-achievers had significantly higher scores on Information, Similarities, Vocabulary, and Comprehension. Although mean Verbal IQ was significantly higher for the high-achieving group, there were no differences for any of the Performance subtests or for the Performance IQ as a whole.

Differences in the pattern of individual VIQ - PIQ discrepancy scores were plotted in frequency distributions for each group. No differences were found between the two distributions. Indeed, VIQ - PIQ discrepancies on the order of 15 points or greater were found to be equally common in both high-achievers and underachievers. This finding underscores the fallacy of confusing statistical significance (i.e., the 15-point difference necessary to conclude with 95% certainty that an individual's VIQ and PIQ differ) with clinical significance (i.e., the mistaken conclusion that a 15-point VIQ-PIQ difference necessarily has prognostic significance and indicates risk for underachievement). Large VIQ-PIQ discrepancies are equally common in high- and low-achieving gifted children; only with the addition of a low achievement test score can a low-achiever be identified. In terms of predicting achievement level using WISC-R subtests, the primary correlates were Information and Comprehension, with Block Design adding a small, but significant, contribution to the variance.

Analysis of gender, ethnicity, and risk further revealed a greater concentration of nonCaucasian males with at least two risk factors in the underachieving group. These findings are consistent with previous studies, which indicate that of the intellectual underachievers, males outnumber females (Gallagher, 1985; Wolfle, 1991), and that many of these students are ethnic minorities (Ford, 1992). Thus, there is a need, as advocated by Gallagher (1985), to provide particular focus on underachieving minority males.

Our results confirm the findings of Bush and Mattson (1973) concerning the importance and discriminating power of the Information subtest in distinguishing high-achievers versus underachievers. Present findings show that the older results with the WISC generalize to the WISC-R. The findings pertaining to the Information subtest, taken at face value, seem to suggest that gifted underachievers simply do not have as much interest or motivation for acquiring factual information as do high-achievers. This suggests that gifted underachievers may require creative teaching strategies, such as making information more relevant and interesting or channeling their abilities into more creative pursuits.

Our findings are also consistent with those reported by Moffitt and Silva (1987). Gifted underachievers are characterized by certain depressed verbal skills; their Performance IQ's are comparable to that of the high-achievers. Thus, we can characterize the gifted underachiever as an individual who has not used his or her potential, or as Cattell (1963) would say, fluid intelligence, to acquire a traditional body of knowledge (i.e., crystallized intelligence). Again, the challenge for teachers is to find ways to motivate these underachievers to make full use of their potential.

Our findings pertaining to gifted underachievers are also relevant to a previous report of the direction of the difference between Verbal versus Performance IQ in 4,546 gifted African-American, Caucasian, Filipino, and Hispanic children (Saccuzzo, Johnson, & Russell, 1992). This study showed that for the typically gifted African-American, the Verbal IQ was actually higher than the Performance IQ. For Hispanics, the Verbal and Performance IQ's were roughly equivalent. Thus, the relevant dimension includes both direction and size; a very high Performance IQ relative to Verbal IQ for an African-American and perhaps an Hispanic should signal the possibility of a gifted underachiever because these individuals tend to have higher Verbal than Performance IQ's. For Filipinos, just the reverse is true since these individuals tend to have higher Performance than Verbal IQ (Saccuzzo et al., 1992). Therefore, while the WISC-R may be biased in terms of selection (Johnson, 1992), it (or its relative, the WISC-III) may still have utility in identifying gifted underachieving African-American and Hispanic/Latino students.

Beyond modification of our educational strategies, researchers have pointed to three major approaches to gifted underachievers. The first focuses on motivational factors (e.g., Boyd, 1990). According to this model there is a need to add excitement or relevance to the learning process in order to help gifted underachievers fulfill their potential. A second approach emphasizes the importance of families as a source of encouragement and support for gifted underachievers (VanTassel-Baska, 1989). The third emphasizes the importance of personality variables, especially locus of control — one's perceived ability to influence or control the events of one's life (Laffoon, Jenkins-Friedman, & Tollefson, 1989; Waldron, Saphire, & Rosenbaum, 1987; Willings & Greenwood, 1990). Certainly any one, two, or all three of these factors play a role in gifted underachievement and need to be considered in addressing the problems of each individual and unique student.

References

Albrecht, H. T. & Rost, D. H. (1983). Uber den Zusammenhang von Hochbegabung und Wohnqualität. Eine Wohnbezirksanalyse aus San Diego, USA. / On the relationship between giftedness and housing quality: A social area analysis of San Diego, USA. *Psychologie in Erziehung und Unterricht, 30,* 281-290.

Alvino, J., McDonnel, R., & Richert, S. (1981). National survey of identification practices in gifted and talented education. *Exceptional Children, 46,* 124-132.

Ascher, C. (1990). *Assessing bilingual students for placement and instruction.* (Report No. EDO-UD 90-5). New York, NY: Columbia University. (ERIC Document Reproduction Service No. ED322273).

Baska, L. (1986A). The use of the Raven Advanced Progressive Matrices for the selection of magnet junior high school students. *Roeper Review, 8,* 181-184.

Baska, L. (1986B). Alternatives to traditional testing. *Roeper Review, 8,* 181-184.

Battle, Ester,& Rotter, J. (1963). Children's feelings of personal control as related to social class and ethnic group. *Journal of Personality, 31,* 482-490.

Ben-Zeev, S. (1977). The effect of bilingualism in children from Spanish-English low economic neighborhoods on cognitive development and cognitive strategy. *Working Papers on Bilingualism, 14,* 83-122.

Bernal, E. M. (1974). *Gifted Mexican American children: An ethnic-scientific perspective.* (Report No. OEC-4-7-062113-307). Washington, D. C.: Office of Education. (ERIC Document Reproduction Service No. EDO91411).

Blake, J. (1974). Developmental changes in visual information processing under backward masking. *Journal of Experimental Child Psychology, 17,* 133-146.

Borland, J. H. (1986). IQ tests: Throwing out the bathwater, saving the baby. *Roeper Review, 8,* 163-165.

Bosco, J. (1972). The visual information processing speed of lower- and middle-class children. *Child Development, 43,* 1418-1422.

Boyd, R. (1990). Academically talented underachievers at the end of high school. *Gifted Education International, 7,* 23-26.

Brown, D., Fulkerson, Fee, K., Furr, S., Ware, W., & Voight, N. L. (1984). Locus of control, sex role orientation, and self-concept in black and white third- and sixth-grade male and female leaders in a rural community. *Developmental Psychology, 20,* 717-721.

Brown, S. W., & Yakimowski, M. E. (1987). Intelligence scores of gifted students on the WISC-R. *Gifted Child Quarterly, 31,* 130-134.

Browne, C. S., & Rife, J. C. (1991). Social, personality, and gender differences in at-risk and not-at-risk sixth-grade students. *Journal of Early Adolescence, 11,* 482-495.

Bruch, C. B. (1971). Modification of procedures for identification of the disadvantaged gifted. *Gifted Child Quarterly, 15,* 267-272.

Burciaga, L.E. (1973). *A research study on the Raven Coloured Progressive Matrices among school children of the El Paso public schools.* Doctoral dissertation, University of El Paso, Texas.

Bush, W. J., & Mattson, B. D. (1973). WISC test patterns and underachievers. *Journal of Learning Disabilities, 6* (4), 54-59.

Caplan, N., Choy, M. H., & Whitmore, J. K. (Feb. 1992). Indochinese refugee families and academic achievement. *Scientific American*, 36-42.

Carlson, J. S. (1989). Advances in research on intelligence: The dynamic assessment approach. *The Mental Retardation and Learning Disability Bulletin, 17*, 1-20.

Carlson, J.S., & Dillon, R. (1978). The effects of testing-the-limits procedures on Raven matrices performance of deaf children. *Volta Review, 4*, 216-224.

Carlson, J. S., & Wiedl, K.H. (1978). Use of testing the limits procedures in the assessment of intellectual capabilities in children with learning difficulties. *American Journal of Mental Deficiency, 82*, 599-564.

Carlson, J. S., & Wiedl, K.H. (1979). Towards a differential testing approach: Testing-the-limits employing the Raven Progressive Matrices. *Intelligence, 3*, 323-344.

Carpenter, P.A., Just, M.A, & Shell, P. (1990). What one intelligence test measures: A theoretical account of the processing in the Raven Progressive Matrices Test. *Psychological Review, 97*, 404-431.

Carroll, J.B. (1992). Cognitive abilities: The state of the art. *Psychological Science, 3*, 266-270.

Cattell, R.B. (1963). Theory of fluid and crystallized intelligence. *Journal of Educational Psychology, 54*, 1-22.

Cauce, A. M., Jacobson, L. I. (1980). Implicit and incorrect assumptions concerning the assessment of the Latino in the United States. *American Journal of Community Psychology, 8*, 571-586.

Cherkes-Julkowski, M., Stolzenberg, J., & Segal, L. (1990). Prompted cognitive testing as a diagnostic compensation for attentional deficits: The Raven Standard Progressive Matrices and attention deficit disorder. *Learning Disabilities, 2*, 1-7.

Chiu, L. (1986). Locus of control in intellectual situations in American and Chinese school children. *International Journal of Psychology, 21*, 167-176.

Clark, B. (1979) *Growing up gifted*. Columbus, OH: Charles E. Merrill.

Cohn, S. J., Carlson, J. S., & Jenson, A. R. (1985). Speed of information-processing in academically gifted youths. *Personality and Individual Differences, 6*, 621-629.

Cooper, H. M., Burger, J. M., & Good, T. L. (1981). Gender differences in the academic locus of control beliefs of young children. *Journal of Personality and Social Psychology, 40*, 562-572.

Cornell, D. G., Callahan, C. M., & Loyd, B. H. (1991). Socioemotional adjustment of adolescent girls enrolled in a residential accelerant program. *Gifted Child Quarterly, 35*, 58-66.

Court, J.H. (1988). *A researcher's bibliography for Raven's Progressive Matrices and Mill Hill Vocabulary Scales (7th Ed.)*. Published by J.H. Court, 500 Goodwood Rd., Cumberland Park, South Australia 5041.

Court, J. H. (1991). Asian applications of Raven's Progressive Matrices. *Psychologia: An International Journal of Psychology in the Orient, 34* (2):75-85.

Court, J.H., & Raven, J. (1982). Summaries of reliability, validity, and normative studies for Raven's Progressive Matrices and Vocabulary Scales. In *A manual for Raven's Progressive Matrices and Mill Hill Vocabulary Scales (Research Supp. No. 2)*. London: H.K. Lewis; San Antonio, TX: Psychological Corporation.

Crandall, V. C., Katkovsky, W., & Crandall, V. J. (1965). Children's beliefs in their own control of reinforcements in intellectual-academic achievement situations. *Child Development*, 36, 91-109.

Cummins, J. (1976). The influence of bilingualism on cognitive growth: A synthesis of research findings and explanatory hypotheses. *Working Papers in Bilingualism, No. 9*. Ontario: Institute for studies in Education.

Cummins, J. (1978). Metalinguisitic development of children in bilingual education programs: Data from Irish and Canadian Ukrainian-English programs. In M. Paradis (Ed.), *The Fourth Locus Forum*. Columbia, S.C.: Hornbeam Press.

Cummins, J. (1981). Empirical and theoretical underpinnings of bilingual education. *Journal of Education, 163* (1), 16-29.

Cummins, J. (1986). Empowering minority students: A framework for intervention. *Harvard Educational Review, 56*(1), 18-36.

Cummins, J. (1989). A theoretical framework for bilingual special education. *Exceptional Children. 56*, 111-119.

Cummins, J., & Gulutsan, M. (1974). Bilingual education and cognition. *Alberta Journal of Educational Research, 20*, 259-266.

Dash, U. N., & Mishra, H. C. (1988). Bilingualism and meta linguistic developments: Evidence from Kond tribal culture. *Journal of Indian Psychology, 7*(2), 7-19.

Diaz, R. M. (1983). Thought and two languages: The impact of bilingualism on cognitive development. In E. W. Gordon (Ed.), *Review of research in education* (Vol. 10, pp. 23-54). Washington, DC: American Educational Research Association.

Dirks, J., Wessels, K., Quarforth, J., & Quenon, B. (1980). Can short-form WISC-R IQ tests identify children with high Full Scale IQ? *Psychology in the Schools, 17*, 40-46.

Dorfman, P. W. (1977). Timing and anticipation: A developmental perspective. *Journal of Motor Behavior, 9*, 67-69.

D'Souza, D. (1991). *Illiberal education: The politics of race and sex on campus*. New York: The Free Press.

DuBois, P. H. (1970). *A history of psychological testing*. Boston: Allyn & Bacon.

Duke, M. P., and Nowicki, S. (1974). Locus of control and achievement-the confirmation of a theoretical expectation. *Journal of Psychology, 87*, 263-267.

Dunham, P. (1977). Age, sex and practice in coincidence-anticipation performance of children. *Perceptual and Motor Skills, 45*, 187-193.

Elman, L., Blixt, S., & Sawicki, R. (1981). The development of cutoff scores on a WISC-R in the multidimensional assessment of gifted children. *Psychology in the Schools, 18*, 426-428.

Emerick, L. J. (1989). The gifted underachiever: Another look. *Preventing School Failure*, 34 (1), 6-9.

Feldman, C., & Shen, M. (1971). Some language-related cognitive advantages of bilingual five-year-olds. *Journal of Genetic Psychology, 118,* 235-244.

Felsten, G., & Wasserman, G. S. (1980). Visual masking: Mechanisms and theories. *Psychological Bulletin, 88,* 329-353.

Fetterman, D. M. (1986). Gifted and talented education: A national test case in Peoria. *Educational Evaluation and Policy Analysis, 8,* 155-156.

Feuerstein, R. (1979). *The dynamic assessment of retarded performers.* Baltimore: University Park Press.

Fincham, F. and Barling, J. (1987). Locus of control and generosity in learning disabled, normal achieving, and gifted children. *Child Development, 49,* 530-533.

Fine, B. (1967). *Underachievers: How they can be helped.* New York: E. P. Dutton.

Finlayson, M.A.J., Johnson, K.A., & Reitan, R.M. (1977). Relationship of level of education to neuropsychological measures in brain-damaged and non-brain-damaged adults. *Journal of Consulting and Clinical Psychology, 45,* 536-542.

Flaugher, R.L., & Rock, D.A. (1972). Patterns of ability factors among four ethnic groups. *Proceedings of the 80th Annual Convention of the American Psychological Association, 7,* 27-28.

Ford, D. Y. (1992). Determinants of underachievement as perceived by gifted, above average, and average black students. *Roeper Review, 14,* 130-136 .

Ford, D. Y, & Harris, J. J. (1990). On discovering the hidden treasure of gifted and talented black children. *Roeper Review, 13,* 27-32.

Fox, L. H. (1981). Identification of the academically gifted. *American Psychologist, 36,* 1103-1111.

Frasier, M. M. (1979). Rethinking the issue regarding the culturally disadvantaged gifted. *Exceptional Children, 45,* 538-542.

Frasier, M. M. (1982). Counseling the culturally diverse gifted. In N. Colangelo & R. T Zaffrann (Eds.), *New voices in counseling the gifted.* Iowa: Kendall/Hunt.

Gallagher, J. J. (1985). *Teaching the gifted child* (3rd ed.). Boston: Allyn and Bacon.

Gallegos, R., & Franco, J. N. (1985). Effects of a bilingual education program on language and academic achievement. *Perceptual and Motor Skills, 60,* 438.

Galton, F. (1869). *Hereditary genius.* Landon & McMillan.

Garcia, J. (1981). The logic and limits of mental aptitude testing. *American Psychologist, 36,* 1172-1180.

Gardner, H. (1983). *Frames of mind : The theory of multiple intelligences.* New York : Basic Books.

Gordon, D. (1977). Children's beliefs in internal-external control and self-esteem as related to academic achievement. *Journal of Personality Assessment, 41,* 383-386.

Gowan, J. C. (1955). The underachieving gifted child - a problem for everyone. *Exceptional Children, 21,* 247-271.

Grinder, R. E. (1985). The gifted in our midst: By their divine deeds, neuroses, and mental test scores we have known them. In F.D. Horowitz & M. O'Brien (Eds.), *The gifted and talented: Developmental perspectives.* Washington, D.C.: American Psychological Association.

Guertin, T., Johnson, N., Saccuzzo, D., & Lopez, C. (1992). Performance at the top: Raven norms for the very gifted. In D.P. Saccuzzo (Chair), *Identifying underrepresented, disadvantaged gifted children: Models and new approaches*. Symposium conducted at the 72nd annual meeting of the Western Psychological Association, Portland, OR.

Guertin, W.H., Frank, G.H., & Rabin, A.I. (1956). Research with the Wechsler-Bellevue Intelligence Scale: 1950-1955. *Psychological Bulletin, 53*, 235-257.

Guertin, W.H., Ladd, C.E., Frank, G.H., Rabin, A.I., & Hiesler, D.S. (1971). Research with the Wechsler Intelligence Scales for Adults. *The Psychological Record, 21*, 289-339.

Guilford, J.P. (1967). *The nature of human intelligence*. New York: McGraw-Hill.

Gurin, P., Gurin, G., Lao, R. C., & Beattie, M. (1969). Internal external control in the motivational dynamics of Negro youth. *Journal of Social Issues, 25*(3), 29-53.

Hagen, E. (1980). *Identification of the gifted*. New York: Teachers College Press.

Haier, R.J., Siegel, B.V., Nuechterlein, K.H., Hazlett, E., Wu, J.C., Paek, J., Browning, H.L., & Buchsbaum, M.S. (1988). Cortical glucose metabolic rate correlates of abstract reasoning and attention studied with positron emission tomography. *Intelligence, 12*, 199-217.

Hakuta, K. (1987). Degree of bilingualism and cognitive ability in mainland Puerto Rican children. *Child Development, 58*, 1372-1388.

Hakuta, K., & Diaz, R. M. (1985). The relationship between degree of bilingualism and cognitive ability: A critical discussion and some new longitudinal data. In K. E. Nelson (Ed.), *Children's language: Volume 5*. Hillsdale, NJ: Lawrence Erlbaum Associates.

Hakuta, K. & Garcia, E. E. (1989). Bilingualism and Education. *American Psychologist*. 44, 374-379.

Haney, G. E. (1963). Problems and trends in migrant education. In A. H. Passow, M. Goldberg, & A. J. Tannenbaum (Eds.), *Education of the disadvantaged* (pp. 100-108). New York: Holt, Rinehart & Winston.

Hannel, G. (1990). Gifted but failing-a case study. *Gifted Education International, 7*, 20-22.

Harty, H., Adkins, D. M., & Sherwood, R. D. (1984). Predictability of giftedness identification indices for two recognized approaches to elementary school gifted education. *Journal of Educational Research, 77*, 337-342.

Heaton, R.K., Grant, I., & Matthews, C.G. (1986). Differences in neuropsychological test performance associated with age, education, and sex. In I. Grant & K.M. Adams (Eds.), *Neuropsychological Assessment of Neuropsychiatric Disorders*. New York: Oxford University Press.

Hennessy, J.J., & Merrifield, P.R. (1976). A comparison of the factor structures of mental abilities in four ethnic groups. *Journal of Educational Psychology, 68*, 754-759.

Hoffman, H. V. (1983). *Regression analysis of test bias in the Raven's Progressive Matrices for Anglos and Mexican-Americans*. Unpublished doctoral dissertation, University of Arizona, Department of Educational Psychology.

Hoffman, H.V. (1986). In J. Raven, J.H. Court, & J. Raven, *Manual for Raven's Progressive Matrices and Vocabulary tests: A compendium of North American normative and validity studies, Research Supp. No. 3*. London: H.K. Lewis.

Horowitz, F.D., & O'Brien, M. (1986). Gifted and talented children: State of knowledge and directions for research. *American Psychologist, 41*, 1147-1152.

Hsieh, Tin-Yee, T. Shybut, J., & Lotsof, E. (1969). Internal versus external control and ethnic group membership. *Journal of Consulting and Clinical Psychology*, 33, 122-124.

Humphreys, L.G. (1992). Commentary: What both critics and users of ability tests need to know. *Psychological Science*, 3, 271-274.

Hunt, E. (1978). Mechanics of verbal ability. *American Psychological Review, 85*, 109-130.

Ianco-Worrall, A. D. (1972). Bilingualism and cognitive development. *Child Development, 43*, 1390-1400.

Irwin, R. J. (1984). Inspection time and its relation to intelligence. *Intelligence, 8*, 47-65.

James, P.R. (1984). A correlational analysis between the Raven's Matrices and WISC-R performance scales. *The Volta Review, 86*, 336-341.

Jensen, A. R. (1979). g: Outmoded theory or unconquered frontier? *Creative Science & Technology, 2*, 16-29.

Jensen, A.R. (1980a). *Bias in mental testing*. New York: Free Press.

Jensen, A. R. (1980b). Chronometric analysis of mental ability. *Journal of Social Biological Structures, 3*, 26.

Jensen, A. R. (1982). Reaction time and psychometric g. In H. G. Eysenck (Ed.), *A model for intelligence*. Berlin: Springer-Verlag.

Jensen, A. R. (1987). Process differences and individual differences in some cognitive tasks. *Intelligence, 11*, 137-136.

Jensen, A. R. (1992). Spearman's hypothesis: Methodology and evidence. *Multivariate Behavioral Research, 27*, 225-233.

Jensen, A. R., & Munro, E. (1979). Reaction time, movement time, and intelligence. *Intelligence, 3*, 121-126.

Jensen, A. R., & Reed, T. E. (1990). Simple reaction times as a suppressor variable in the chronometric study of intelligence. *Intelligence, 14*, 375-388.

Johnson, N. E. (1992). Use of the WISC-R with disadvantaged gifted children: Current pratice, limitations, and ethical concerns (Doctoral dissertation, San Diego State University / University of California, San Diego. *Dissertation Abstracts International, 53*, (5-B): 2544.

Kanoy, R. C., III. (1980). Locus of control and self-concept in achieving and underachieving bright elementary students. *Psychology in the Schools, 17*, 395-399.

Kaplan, R., & Saccuzzo, D.P. (1989). *Psychological testing: Principles, applications, and issues* (2nd ed.). Pacific Grove, CA: Brooks/Cole.

Kaplan, R., & Saccuzzo, D.P. (1993). *Psychological testing: Principles, applications, and issues* (3rd ed.). Pacific Grove, CA: Brooks/Cole.

Karnes, F.A., & Brown, K.E. (1981). A short form of the WISC-R for gifted students. *Psychology in the Schools, 18*, 169-173.

Karnes, F. A., Lee, L. A., & May, B. (1982). Correlations among scores on the 1966, 1973, and 1979 norms of Raven's Standard Progressive Matrices for economically disadvantaged students. *Perceptual & Motor Skills, 55* , 793-794.

Kaufman, A. S. (1976). Verbal-performance discrepancies on the WISC-R. *Journal of Consulting and Clinical Psychology, 44*, 739-744.

Kaufman, A. S. (1979). *Intelligent testing with the WISC-R.* New York: Wiley-Interscience.

Kaufman, A. S., & Doppelt, J. E. (1976). Analysis of WISC-R standardization data in terms of the stratification variables. *Child Development, 47*, 165-171.

Kaufman, A. S. & Harrison, P. L. (1986). Intelligence tests and gifted assessment: What are the positives? *Roeper Review, 8*, 154-159.

Kaufman, A.S., & Kaufman, N.L. (1983). *Kaufman Assessment Battery for Children (K-ABC) interpretive manual.* Circle Pines, MN: American Guidance Service.

Kier, G. (1949). The Progressive Matrices as applied to school children. *British Journal of Statistical Psychology, 2*, 140-150.

Killian, J.B. & Hughes, L.C. (1978). A comparison of short forms of the Wechsler Intelligence Scale for Children-Revised in the screening of gifted referrals. *Gifted Child Quarterly, 22*, 111-115.

Klausmeier, K., Mishra, S. P., & Maker, C. J. (1987). Identification of gifted learners: A national survey of assessment practices and training needs of school psychologists. *Gifted Child Quarterly, 31*, 135-137.

Kostas, D., Saccuzzo, D. P., & Larson, G. E. (1987). *No movement reaction time as a function of Hick's Law.* Paper presented at the 67th Annual Meeting of the Western Psychological Association, Long Beach, CA.

Kranzler, J. H., & Jensen, A. R. (1989). Inspection time and intelligence: A meta-analysis. *Intelligence, 13*, 329-347.

Laffoon, K., Jenkins-Friedman, R., & Tollefson, N. (1989). Causal attributions of underachieving gifted, achieving gifted and nongifted students. *Journal for the Education of the Gifted, 13*, 4-21.

Lajoie, S. P., & Shore, B. M. (1981). Three myths? The over-representation of the gifted among dropouts. *Gifted Child Quarterly, 25*, 138-143.

Lally, M., & Nettlebeck, T. (1977). Intelligence, reaction time, and inspection time. *American Journal of Mental Deficiency, 82*, 273-281.

Landry, R. B. (1974). A comparison of second language learners and monolinguals on divergent thinking tasks at the elementary school level. *Modern Language Journal, 58*, 10-15.

Larson, G. E. (1989). A brief note on coincidence timing. *Intelligence, 13*, 361-367.

Larson, G. E. (1986). *The Mental Counters Test.* San Diego: Navy Personnel Research and Development Center.

Larson, G. E., & Rimland, B. (1984). *Cognitive speed and performance in Basic Electricity and Electronics (BE&E) School* (Report No. 85-3). San Diego: Navy Personnel Research and Development Center.

Larson, G. E., & Saccuzzo, D. P. (1989). Cognitive correlates of general intelligence: Toward a process theory of *g*. *Intelligence, 13*, 5-31.

Laslow, A., & Nelson, P. (1974). Testing the gifted child in the elementary school. *Gifted Child Quarterly, 18*, 152-162.

Lefcourt, H.M. (1966). Internal versus external control of reinforcement: A review. *Psychological Bulletin, 65*, 206-220.

Lesser, G. S., Fifer, G., & Clark, D. H. (1965). Mental abilities of children from different social-class and cultural groups. *Monographs of the Society for Research in Child Development, 30* (4), 1-115.

Lewandowski, D.G., & Saccuzzo, D.P. (1976). The decline of psychological testing. *Professional Psychology, 7*, 177-184.

Lindholm, K. J. (1991). Theoretical assumptions and empirical evidence for academic achievement in two languages. *Hispanic Journal of Behavioral Sciences, 13*(1), 3-17.

Liss, P. H., & Haith, M. M. (1970). The speed of visual processing in children and adults: Effects of backward and forward masking. *Perception and Psychophysics, 8*, 396-398.

Lunneborg, C. (1978). Some information-processing correlates of measures of intelligence. *Multivariate Behavioral Research, 13*, 153-161.

Lynn, R., & Holmshaw, M. (1990). Black-White differences in reaction times and intelligence. *Social Behavior and Personality, 18*, 299-308.

Mackintosh, N. J. (1981). A new measure of intelligence? *Nature, 289*, 529-530.

Marshalek, B., Lohman, D.F., & Snow, R.E. (1983). The complexity continuum in the radex and heirarchical models of intelligence. *Intelligence, 7*, 107-127.

Matarazzo, J. D., & Herman, D. O. (1984). Base rate data for the WAIS-R: Test-retest stability and VIQ-PIQ differences. *Journal of Clinical Neuropsychology, 6*, 351-366.

Mather, N., & Udall, A. J. (1985). The identifaction of gifted underachievers using the Woodcock-Johnson Psycho-Educational Battery. *Roeper Review, 8*, 54-56.

McClelland, R., Yewchuk, C., & Mulcahy, R. (1991). Locus of control in underachieving and achieving gifted students. *Journal for the Education of the Gifted, 14*, 380-392.

McKenzie, J. A. (1986). The influence of identification practices, race and SES on the identification of gifted students. *Gifted Child Quarterly, 30*, 93-95.

Meeker, M. (1973). *Patterns of giftedness in Black, Anglo, and Chicano boys ages 4-5 and 7-9.* Paper presented to the First National Conference for Disadvantaged Gifted, Ventura County, CA.

Meeker, M.N., & Meeker, R. (1973). Strategies for assessing intellectual patterns in Black, Anglo, and Mexican-American boys—or any other children—and implications for education. *Journal of School Psychology, 11*, 341-350.

Melesky, T. J. (1985). Identifying and providing for the Hispanic gifted child. *The journal for the national association for bilingual education, 9* (3), 43-56.

Millett, S. (1990). *Annual evaluation of the gifted and talented education program, 1989-90.* San Diego: San Diego City Schools Evaluation Department Report Number 647.

Moffitt, T. E., & Silva, P. A. (1987). WISC-R verbal and performance IQ discrepency in an unselected cohort: clinical significnce and longitudinal stability. *Journal of Consulting and Clinical Psychology, 55*, 768-774.

Nettelbeck, T. (1982). Inspection time: An index for intelligence? *Quarterly Journal of Experimental Psychology, 34A*, 299-312.

Nettlebeck, T. (1987). Inspection time and intelligence. In P.A. Vernon (Ed.) *Speed of information processing and intelligence*. Norwood, NJ: Ablex Publishing Co.

Nettelbeck, T., & Lally, M. (1976). Inspection time and measured intelligence. *British Journal of Psychology, 67*, 17-22.

Newell, M., d'Lberville, L. (1989). Adapting the triad model to serve gifted underachievers. *Gifted Education International, 6*, 98-101.

Nichols, P. L., & Anderson, V. E. (1973). Intellectual performance, race, and socioeconomic status. *Social Biology, 20*, 367-374.

Nowicki, S. Jr., & Strickland, B. R. (1973). Locus of control scale for children. *Journal of Consulting and Clinical Psychology, 40*, 148-154.

Nyquist, E. (1973). *The gifted: The invisably handicapped or there is no heavier burden than great potential*. Paper presented at the National Conference on the Gifted, Albany, N.Y.

Ortiz, A. A. (1991). Assessment and intervention model for the bilingual exceptional student. *Teacher education and special education, 14* (1), 35-42.

Passow, A. H. (1989). Needed research and development in educating high ability children: An editorial. *Roeper Review, 11*, 223-229.

Payne, B. D., and Payne, D. A. (1989). Sex, race, and grade differences in the locus of control orientations of at-risk elementary students. *Psychology in the Schools, 26*, 84-88.

Peal, E., & Lambert, W. E. (1962). The relation of bilingualism to intelligence. *Psychological Monographs: General and Applied, 76*, 1-23.

Pearce, N. (1983). A comparison of the WISC-R, Raven's Standard Progressive Matrices, and Meeker's SOI - Screening Form for Gifted. *Gifted Child Quarterly, 27*, 13-19.

Pegnato, C.W., & Birch, J.W. (1959). Locating children in the junior high school: A comparison of methods. *Exceptional Children, 25*, 300-304.

Pirozzo, R. (1982). Gifted Underachievers. *Roeper Review, 4* (4), 18-21.

Pledgie, T. K. (1982). Giftedness among handicapped children: Identification and programming development. *Journal of Special Education, 16*, 221-227.

Poulton, E. C. (1950). Perceptual anticipation and reaction time. *Quarterly Journal of Experimental Psychology, 2*, 99-112.

Powers, S., & Barkan, J.H. (1986). Concurrent validity of the Standard Progressive Matrices for hispanic and nonhispanic seventh-grade students. *Psychology in the Schools, 23*, 333-336.

Powers, S., Barkan, J.H. , & Jones , P.B. (1986). Reliability of the Standard Progressive Matrices Test for Hispanic and Anglo-American children. *Perceptual and Motor Skills, 62*, 348-350.

Raven, J. (1989). The Raven Progressive Matrices: A review of national norming studies and ethnic and socioeconomic variation within the United States. *Journal of Educational Measurement, 26*, 1-16.

Raven, J., Summers, W.A., et al. (1986, 1990). A compendium of North American normative and validity studies. In J.C. Raven, J.H. Court, and J. Raven, *A manual for Raven's Progressive Matrices and vocabulary tests (Research Supp. No. 3)*. London: H.K. Lewis; San Antonio, TX: Psychological Corporation.

Raven, J.C. (1938). *Progressive matrices: A perceptual test of intelligence*. London: H.K. Lewis.

Raven, J.C. (1958). *Standard Progressive Matrices*. San Antonio, TX: Psychological Corporation.

Raven, J.C. (1960). *Guide to the Progressive Matrices*. London: H.K. Lewis.

Reitan, R.M. (1955). The distribution according to age of a psychologic measure dependent on organic brain functions. *Journal of Gerontology, 10*, 338-340.

Renzulli, J.S. (1978). What makes giftedness? Reexamining a definition. *Phi Delta Kappan, 60*, 180-184.

Reynolds, A. G. (1991). The cognitive consequences of bilingualism, In A. G. Reynolds (Ed.), *Bilingualism, multiculturalism, and second language learning: The McGill conference in honour of Wallace E. Lambert*. Hillsdale, NY: Lawrence Erlbaum Associates, Publishers.

Richert , E.S. (1985). The state of the art of identification of gifted students in the United States. *Gifted Education International, 3*, 47-51.

Richert , E.S. (1986). Toward the Tao of giftedness. Special Issue: The IQ controversy. *Roeper Review, 8* , 197-204.

Richert, E. S. (1987). Rampant problems and promising practices in the identification of disadvantaged gifted students. *Gifted Child Quarterly, 31* , 149-154.

Richert, E.S., Alvino, J.J., & McDonnel, R.C. (1982). *National report on identification: Assessment and recommendations for comprehensive identification of gifted and talented youth*. Sewell, NJ:Educational Improvement Center.

Rimm, S. B. (1988). Family environments of underachieving gifted students. *Gifted Child Quarterly, 32*, 353-359

Robinson, N. M., & Chamrad, D. L. (1986). Appropriate uses of intelligence tests with gifted children. *Roeper Review, 8*, 160-163.

Rotter, J. B. Generalized expectancies for internal versus external control of reinforcement. *Psychological Monographs, 80*, (Whole No. 609).

Rotter, J. B. (1975). Some problems and misconceptions related to the construct of internal versus external control of reinforcement. *Journal of Consulting and Clinical Psychology, 43*, 56-67.

Saccuzzo, D. P. (1993). *Identifying underrepresented disadvantaged gifted and talented children: A multifaceted approach*. (Available from D.P. Saccuzzo, Ph.D.; San Diego State University; 6363 Alvarado Court,Suite 103; San Diego, CA 92120-4913).

Saccuzzo, D.P., Hermanson, D.P., Dorne, M., Johnson, N.E., & Shamieh, E. (1990). *The identification of giftedness as a function of ethnic background*. Paper presented at the meeting of the Western Psychological Association, Los Angeles.

Saccuzzo, D. P., & Johnson, N. E. (1992). *Symposium overview: Evaluating giftedness across ethnic backgrounds: Traditional vs nontraditional approaches.* Abstracts of seven presentations prepared for the WPA-RMPA Annual Meeting, April 22-25, 1993, Phoenix.

Saccuzzo, D. P., & Johnson, N. E. (undated). *Identifying underrepresented gifted and talented children: Results for 35,000 culturally diverse children.* Proposal to present at Javits conference on December 11.

Saccuzzo, D. P., Johnson, N. E., & Guertin, T. L. (1993). *Information-processing in gifted vs nongifted African-American, Latino, Filipino, and white children: Speeded vs nonspeeded paradigms.* Manuscript submitted for publication.

Saccuzzo, D. P., Johnson, N.E., & Russell, G. (1992). Verbal versus performance IQs for gifted African-American, Caucasian, Filipino, and Hispanic children. *Psychological Assessment, 4,* 239-244.

Saccuzzo, D. P., Kerr, J., Marcus, A., & Brown, R. (1979). Input capability and speed of information-processing in mental retardation. *Journal of Abnormal Psychology, 88,* 341-345.

Saccuzzo, D. P., & Larson, G. E. (1987). *Analysis of test-retest reliability for a battery of cognitive speed tests.* (Report No. 88-10). San Diego CA: Navy Personnel Research and Development Center.

Saccuzzo, D. P., Larson, G. E., & Rimland, B. (1986). Visual, auditory and reaction time approaches to the measurement of speed of information processing and individual differences in intelligence. *Personality and Individual Differences, 2,* 659-668.

Saccuzzo, D.P., & Lewandowski, D.G. (1976). The WISC as a diagnostic tool. *Journal of Clinical Psychology, 32,* 115-124.

Saccuzzo, D. P., & Marcus, A. (1983). *Speed of information processing in mental retardation improves with practice.* Paper presented at the 63rd Annual Meeting of the American Psychological Association, San Francisco, CA.

Saccuzzo, D. P., & Michael, B. (1984). Speed of information processing and structural limitations in retarded and dual-diagnosed retarded-schizophrenic persons. *American Journal of Mental Deficiency, 89,* 187-195.

Salthouse, T. A., & Prill, K. (1983). Analysis of a perceptual skill. *Journal of Experimental Psychology: Human Perception and Performance, 9,* 607-621.

San Diego City Schools. (1992). *Procedures for the certification of gifted and talented students 1992-1993.* San Diego, CA: San Diego City Schools, School Services Division, Exceptional Programs Department.

Sattler, J.M. (1988). *Assessment of children.* San Diego: Jerome M. Sattler, Publisher.

Shaklee, B. D. (1992). Identification of young gifted students. Special issue: Early childhood. *Journal for the Education of the Gifted, 15 (2),* 134-144.

Shaw, F.W. II (1986). Identification of the gifted: Design defects and the law. *Urban Education, 21,* 42-61.

Sidles, C., & MacAvoy, J. (1987). Navajo adolescents' scores on a primary language questionnaire, the Raven Standard Progressive Matrices (RSPM), and the Comprehensive Test of Basic Skills (CTBS): A correlational study. *Educational and Psychological Measurement, 47,* 703-709.

Sitkei, E.G., & Meyers, C.E. (1969). Comparative structure of intellect in middle- and lower-class four-year-olds of two ethnic groups. *Developmental Psychology, 1,* 592-604.

Smith, G. A., & McPhee, K. A. (1987). Performance on a coincidence timing task correlates with intelligence. *Intelligence, 11,* 161-167.

Smith, G. A., & Stanley, G. (1983). Clocking g: Relating intelligence and measures of timed performance. *Intelligence, 7,* 353-368.

Snow, R.E., Kyllonen, P.C., & Marshalek, B. (1984). The topography of ability and learning correlations. In R.J. Sternberg (Ed.), *Advances in the psychology of human intelligence* (Vol. 2, pp. 47-103). Hillsdale, NJ: Erlbaum.

Span, P., & Overtoom-Corsmit, R. (1986). Information processing by intellectually gifted pupils solving mathematical problems. *Educational Studies in Mathematics, 17,* 273-295.

Spearman, C. (1904). "General intelligence" objectively determined and measured. *American Journal of Psychology, 15,* 210-293.

Spearman, C.E. (1923). *The nature of intelligence and the principles of cognition.* London: Macmillan.

Spearman, C. (1927a). *The abilities of man.* New York: MacMillan.

Spearman, C. (1927b). *The nature of "intelligence" and the principles of cognition* (2nd ed.). London: MacMillan.

Sternberg, R.J. (1981). A componential theory of intellectual giftedness. *Gifted Child Quarterly, 25,* 86-93.

Sternberg, R.J. (1982). Lies we live by; Misapplication of tests in identifying the gifted. *Gifted Child Quarterly, 26,* 157-161.

Sternberg, R. J., & Davidson, J. E. (1983). Insight in the gifted. *Educational Psychologist, 18,* 51-57.

Sternberg, R.J. (1986). *Intelligence applied: Understanding and increasing your intellectual skills.* San Diego: Harcourt Brace Jovanovich.

Stevenson, H. W., Chen, C., & Uttal, D. H. (1990). Beliefs and achievement: A study of Black, White and Hispanic children. *Child Development, 61,* 508-523.

Sullivan, A. R. (1973). The identification of gifted and academically talented black students: A hidden exceptionality. *Journal of Special Education, 7,* 373-379.

Sunset Review Advisory Committee III (1986). *Sunset Review Advisory Committee III Report: A report to the legislature.* Sacramento, CA: California State Department of Education.

Supplee, P. L. (1989). Students at risk: The gifted underachiever. *Roeper Review, 11,* 163-166.

Terman, L.M. (1916). *The measurement of intelligence.* Boston: Houghton-Mifflin.

Thomas, J. A., Gallagher, J., & Purvis, J. (1981). Reaction time and anticipation time: Effects of development. *Research Quarterly for Exercise and Sport, 52,* 359-367.

Thorndike, E.L. (1927). *The measurement of intelligence.* New York: Bureau of Publications, Teachers College, Columbia University.

Tulkin, S.R., & Newbrough, J.R. (1968). Social class, race, and sex differences on the Raven (1956) Standard Progressive Matrices. *Journal of Consulting and Clinical Psychology, 15,* 201-293.

Valencia, R. (1984). Reliability of the Raven Coloured Progressive Matrices for Anglo and for Mexican-American children. *Psychology in the Schools, 21,* 49-52.

VanTassel-Baska, J. (1989). The role of the family in the success of disadvantaged gifted learners. *Journal for the Education of the Gifted, 13,* 22-36.

Vernon, P. A. (1981). Reaction time and intelligence in the mentally retarded. *Intelligence, 5,* 345-355.

Vernon, P. A. (1987). *Speed of information-processing and intelligence.* Norwood, NJ: Ablex Publishing Co.

Vernon, P. A., Nador, S., & Kantor, L. (1985). Reaction times and speed-of-processing: Their relationship to timed and untimed measures of intelligence. *Intelligence, 9,* 357-374.

Vernon, P.E. (1950). *The structure of human abilities.* New York: Wiley.

Vickers, D., Nettelbeck, T., & Willson, R. J. (1972). Perceptual indices of performance: The measurement of "inspection time" and "noise" in the visual system. *Perception, 1,* 263-295.

Vygotsky, L. S. (1962). *Thought and language.* (E. Hanfmann & G. Vakar, Eds. and Trans.). Cambridge, MA: MIT Press. (Original work published 1934).

Wagner, R. K., & Sternberg, R. J. (1984). Alternative conceptions of intelligence and their implications for education. *Review of Educational Research, 54,* 179-224.

Waldron, K. A., Saphire, D. G., & Rosenbaum, S. A. (1987). Learning disabilities and giftedness: Identification based on self concept, behavior, and academic patterns. *Journal of Learning Disabilities, 20* (7, 422-427): 432.

Wallerstein, J. S. (1985). The overburdened child: Some long-term consequences of divorce. *Social Work, 30,* 116-123.

Wechsler, D. (1958). *The measurement and appraisal of adult intelligence* (4th ed.). Baltimore: Williams & Wilkins.

Whitmore, J. R. (1980). *Giftedness, conflict, and underachievement.* Boston: Allyn & Bacon.

Wiener, G., & Milton, T. (1970). Demographic correlates of low birth weight. *American Journal of Epidemiology, 91,* 260-272.

Willings, D., & Greenwood, B. (1990). Some ways of helping underachievers. *Gifted Education International, 7,* 27-32.

Wolfe, J. A. (1991). Underachieving gifted males: Are we missing the boat? *Roeper Review, 13,* 181-184.

Young, T W. & Shorr, D. N. (1986). Factors affecting locus of control in school children. *Genetic, Social, and General Psychology Monographs, 112,* 405-417.

Zentella, A. C. (1981). Language variety among Puerto Ŕicans. In C. A. Ferguson & S. B. Health (Eds.), *Language in the USA* (pp. 218-238). New York: Cambridge University Press.

Zigler, E., & Farber, E.A. (1985). Commonalities between the intellectual extremes: Giftedness and mental retardation. In F.D. Horowitz & M.D. O'Brien (Eds.), *The gifted and talented: Developmental perspectives.* Washington, D.C.: American Psychological Association.

Zilli, M. G. (1971). Reasons why the gifted adolescent underachieves and some of the implications of guidance and counseling to this problem. *Gifted Child Quarterly, 15,* 279-292.